ASSESSMENT AND STRATEGIES

FY 2011 – FY 2015

Prepared in accordance with:

COASTAL ZONE MANAGEMENT ACT - SECTION 309

By:

PUERTO RICO COASTAL MANAGEMENT PROGRAM

June 2011

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INTRODUCTION

The following Assessment and Strategy was developed pursuant to Section 309 of the Coastal Zone Management Act (CZMA). The document is structured to conform to CZMA Section 309 Program Enhancement Guidance issued by NOAA Office of Ocean and Coastal Resources Management covering the period FY2011-2015.

The PRCMP 309 Assessment is based on information generated at DNER's Coastal Management Office or provided by Federal and Commonwealth agencies, municipalities, as well as information provided by the public. The assessment summarizes trends and current status of resources pertaining to the priority enhancement areas identified for Puerto Rico.

The PRCMP 309 Strategies were developed for the selected priority areas in coordination with PRCMP partners. The strategies integrate initiatives to promote increased cooperation among Federal and Commonwealth agencies in order to maximize the value of the investment of 309 funds. This introduction summarizes how the assessment and program enhancement strategies were developed and reviewed. A summary of the public comments and how they were addressed is provided under section F.

Once NOAA OCRM provides comments on the draft PRCMP 309 Assessment and Strategy, CMO will edit and publish the final document.

A. Conformance to OCRM Guidance

In July 2009, NOAA/OCRM issued the final draft guidance for the Section 309 Program which considerably streamlines the Assessment and Strategy. This document has adhered as closely as possible to those guidelines.

The Strategy covers the five year period FY 2011– FY 2015. It is understood that OCRM's acceptance of the Assessment and Strategy is an eligibility requirement for receiving new Section 309 funding beginning in FY 2011.

The main body of the report is organized by program enhancement area. For the two priority program areas ---Coastal Hazards and Wetlands – the strategy section follows the assessment. A general approach to Coastal and Marine Spatial Planning has been devised for Ocean Resources which interrelates with other program enhancement areas for which no strategies have been prepared. No strategies were developed for enhancement areas with a medium or low priority ranking .

B. Prior Cycle of Sec.309 Assessment and Strategy

In July 2008, PRDNER submitted an updated and revised Section 309 Assessment and Strategy to OCRM. In the intervening period between the 2008 submission and the present, coastal development trends have remained largely unchanged due to slow economic activity and a major contraction in the construction sector.

The economic downturn beginning in 2008 and continuing to the present has brought a halt to most new building development in both the private and public sectors. Puerto Rico's macroeconomic indicators reflect that the Commonwealth's economy is centered on high value- added services and manufacturing. During 2009, the gross domestic product was nearly $95.7 billion, with a GDP per capita of over $24,000. The Gross National Product[1] was 62.8 billion. As of February 2010, the labor force was around 1.3 million strong, of which 1.1 million were employed. Mean household income was over $28,000 (Source: Government Development Bank).

According to the Government Development Bank, the Puerto Rico GDP composition by sector (2009) is distributed as follows: Manufacturing, 45.5%; finance, insurance and real estate, 19%; services, 12.8%; government, 9.7%; trade, 7.8%; transportation and other public utilities, 3.2%; construction and mining, 1.9%; and agriculture, 0.7%.

The 2009 statistics reflect a major contraction in the construction and transportation sectors. While planning, project design and permitting processes for future coastal development are continuing, only a few construction projects are actively underway. Budgetary constraints and employment reductions have likewise moderated governmental activities with respect to public works and new program initiatives.

Proposed Section 309 program activities are consistent with inputs received from key Commonwealth and federal agencies. These include the Puerto Rico Planning Board, Department of Recreation and Sports, National Parks Company, Environmental Quality Board, U.S. Fish and Wildlife Service, U.S. Forest Service, International Institute of Tropical Forestry, National Marine Fisheries Service, and the Natural Resources Conservation Service and the results of a PRCMP survey designed to obtain public comment on 309 program priorities. The three highest priority areas were Coastal Hazards and Coastal Habitats, Wetlands, and Public Access followed by Marine Debris, Ocean Resources, Aquaculture, Energy Facility Siting, Special Planning Areas and Cumulative Impact Analysis.

Each assessment section of this document provides specific accomplishments of the previous 309 funding cycle. This introduction highlights some of the accomplishments under the PRCMP public access, wetlands and coastal hazards strategies (2006-2010):

Public access:

- DNER Secretary submitted public access cooperation agreements to the majors of the 44 Coastal Municipalities.
- Six cooperation agreements between DNER and Coastal Municipalities have been signed.
- Coastal access guides have been completed for all coastal sectors of the main Island of Puerto Rico.

- Coastal access guides for Culebra and Vieques islands will be completed using 309 funds.
- All Puerto Rico, Culebra and Vieques islands access guides will be integrated as part of the Island-wide coastal access master guide).

Wetlands:

- PRCMP completed the atlas of coastal wetlands and wetlands land tenure.
- PRCMP completed the draft guidelines for submerged lands zoning.
- PRCMP prepared the draft zoning for submerged lands of the Southeast of Puerto Rico. This document was submitted to PRPB for evaluation and adoption as part of the Island-wide Land Use Pan.
- Governor of Puerto Rico issued Executive Order 2008-53 creating the Interagency Wetlands Committee.

Coastal Hazards:

- PRCMP completed the evaluation of coastal features functions as non-structural forms of coastal hazards mitigation..
- PRCMP supported the collection of aerial photography that were used to model a 1 meter sea level rise scenario.
- PRCMP identified critical infrastructure of the metropolitan area vulnerable to a 1 meter sea level rise.
- PRCMP evaluated coastal areas that would be potentially affected by sea level rise.
- PRCMP and the UPR-CariCOOS modelers identified a problem of accuracy associated to the lack of enhanced elevation data for Puerto Rico. NOAA-NGS is soon to complete the Puerto Rico Vertical Datum (PRVD02) which will enable modelers to increase accuracy on their sea level rise, storm surge, and tsunami inundation projections. Once the higher accuracy inundation projections are completed, PRCMP can use Maximum of Maximums (MOM) inundation lines and reassess vulnerable areas .
- Governor of Puerto Rico created the Puerto Rico Advisory Committee via Executive Order.2008-09.

C. Considerations in Revising the Sec. 309 Program Strategy

1. **Climate variability and change and sea level rise adaptation**

The potential impacts of climate change on ocean islands is cause for increasing concern as the threat of sea level rise and severe weather events grow in frequency and intensity. As documented in the updated PRCZM Program Document, a preponderance of Puerto Rico's population and economic activities are concentrated in low lying areas some of which are subject to direct impacts of coastal flooding and storm surge. Projections of sea level rise made by the Caribbean Ocean Observing System group, based on historical trends, forecast a 0.25 cm rise in sea level by year 2100. IPCC and Potsdam Institute for Climate Research have produced different sea level rise scenarios that have been analyzed by PRCMP-CMO. In its 2007 report, the Intergovernmental Panel on Climate

Change (IPCC) projected a global sea level rise of 18 to 59 centimeters from 1990 to the 2090s, plus an unspecified increase that could result from further melting of the ice sheets covering Greenland and Antarctica. Rahmstorf and Pfeffer et al. have revised these projections to 1.4 and 2 meter sea level rise scenarios. PRCMP will be using two sea level rise scenarios for planning and adaptation strategies: an upper limit of 1 meter and a conservative scenario of 0.25 cm over the course of the next 90 years.

2**. Convergence of Sec. 309 priority program areas**

The overall strategy for the new cycle of Sec. 309 activities is based on the interrelationship between coastal hazards, wetlands preservation, coastal and marine spatial planning. Pursuing work on these components in a coordinated way represents an opportunity for coastal zone management to play a central role in contributing to sustainable development while simultaneously enhancing coastal ecosystems.

There is continuing public discussion and elevated awareness about global warming, weather modification, and potential sea level rise. Such awareness is a precondition for developing "community resilience" in preparing for natural disasters. This rethinking of program strategies, within the overall context of global warming and sea level rise follows from the work conducted in past program cycles.

- Coastal hazards analyses have provided the information base and scientific rationale for new and innovative program responses to climate variability and change as well as potentially catastrophic events;

- Wetlands zoning provides the basis for a wetlands management program that combines both coastal protection and ecosystem enhancement;

- Ocean resources provides an excellent planning framework to integrate coastal and marine ecosystems and socioeconomic systems and to generate management recommendations for guiding public and private development of our coasts.

D. Responding to emergent public concerns related to coastal hazards

The design of the Sec 309 Strategy stems from the growing awareness of the dangers posed by coastal storms and hurricanes. Puerto Rico faced extraordinary ocean swells (March and September 2008) as well as associated inundation events which severely impacted several coastal communities. These events increased beach erosion in already affected areas such as Rincon.

PRCMP-CMO's concern for recurring rainfall and extraordinary storm surge and swell events affecting coastal communities (2008, 2009 and 2010) demanded a shift of focus in Puerto Rico's coastal hazards strategy, in turn, prompting a parallel shift in overall Sec. 309 program strategy.

Key natural systems, such as intertidal wetlands and key geomorphic features function as coastal barriers providing protection to coastal communities. It follows that geo-referencing, mapping, protecting and effectively managing these systems becomes a key component of the coastal hazards strategy.

E. Funding constraints

A consideration in designing the Sec.309 program strategy is funding. This document reviews the highlights of Section 309 activities undertaken by the DNER Coastal Zone Management through September 2010, and recommends redirection of the strategy of the program enhancement process for the 2011 – 2015 program cycle.

Funding poses a major constraint in the design of the Section 309 Strategy. The recommendations being advanced are based on the assumption that full federal funding for Section 309 will be available, under successive CZMA reauthorization provisions, through FY2016.

In designing the general work plan for the priority enhancement areas, the following assumptions have been made with respect to future funding:

- OCRM will direct approximately 15% to the Sec. 309 program ;

- Unlike 306 funds which require a 50% state match, 309 funds will continue to require no local match. However, PRCMP-CMO has established a collaborative agreement with University of Puerto Rico and Sea Grant for the implementation of CC-SLR and Public Access strategies. This partnership greatly increases CMO capabilities for implementing the PR 309 Strategy.

- During FY11, PRCMP expects that DNER Secretary and Coastal Municipality majors sign Cooperation Agreements (Six out of 44 have signed Public Access agreements). PRCMP-CMO will complete public access guides for Culebra and Vieques and will develop the Island-wide Public Access master guide. PRCMP will initiate the development of a web-based Wetlands data management center and will complete the preliminary climate change coastal vulnerability assessment.

F. Methodology used in ranking priority program areas

In developing this revised Sec. 309 program, PR DNER pursued a course similar to that followed in previous 309 iterations. The methodology relied on eliciting the views and opinions of knowledgeable individuals, Federal and Commonwealth agency staff, environmental organizations, and a cross-section of public opinion. Nevertheless, a final decision on strategy design is made by DNER with concurrence by OCRM.

1. Use of questionnaire

A limited opinion survey was conducted among concerned and informed citizens and environmental professionals. Among the findings was the high level of concern expressed by respondents about coastal hazards, particularly hurricanes and coastal flooding and the recognition of the importance of coastal wetlands to ameliorate the impacts of inundations associated with storm surge and rainfall events. This process generated well focused inputs which enable PRCMP-CMO to clarify terms and improve enhancement categories assessments.

2. Consultative process

Consultations on the 309 Assessment and Strategy were held with staff and officials of the Planning Board, the Environmental Quality Board, Department of Recreation and Sports, U.S. Fish and Wildlife Service, National Marine Fisheries Service, Natural Resources Conservation Service, International Institute of Tropical Forestry and other agencies. As required by federal guidelines the final draft of the Assessment and Strategy developed under CZMA, Section 309 for the period 2011-2015 was posted for a 30 days public review period (DNER Portal and PRCMP web page). Public comments were received at the PRCMP email account and integrated to the assessment sections of the different categories. Recommendations made to the strategies section of the document were embedded as part of each specific year of the coastal hazards and wetlands program enhancement strategies. It is important to emphasize that PRCMP received more (37) and well focused comments through the public survey. Fewer comments were received during the public review period. There were important comments providing additional inputs to the special planning areas, public access, energy and government facility siting, and aquaculture assessments. These comments focused on the need for funding to improve public access and natural reserves management. One comment highlighted problems associated to the preparation of management plans for natural reserves with no designated managers. Management plans would stay on paper. The same person indicated that in order to improve coastal resources management there is a growing need for environmental education. Other comment pointed out that government's layoffs will adversely impact natural resources of the island. Several people commented that the Puerto Rico Tourism Company should provide funding to support coastal areas conservation, maintenance, and enhancement. It was suggested that coastal management receive additional funding from a percentage of public coastal trust lands concession fees and public private partnerships to address staffing issues as well as infrastructure development and maintenance. While this sounds like a good idea, DNER will pursue it through a different Commonwealth program. There was one comment related to LNG pipeline and wind generators siting and construction. PRCMP-CMO comments on all energy projects proposed to be built on the coastal zone. Also, most of these projects require a federal permits; therefore, projects are reviewed by the Puerto Rico Planning Board (PRPB) Federal Consistency Office (FCO). Most of the coastal stakeholders that provided comments through the survey and during the public review period ranked coastal hazards and wetlands as number 1 and 2 priorities.

PROGRAM ENHANCEMENT ASSESSMENTS

WETLANDS ASSESSMENT

Section 309 Enhancement Objective

Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands.

Summary of 2006-2010 Program Accomplishments

During the 2006-2010 Sec. 309 cycle significant program accomplishments included: (1) Preparation of zoning guidelines for submerged lands as a means of implementing wetland protection policies; (2) delineation of zoning boundaries and mapping of zoning districts in coastal waters along the Caribbean coast as an innovative management measure for protecting submerged lands, and; (3) consensus building through outreach and networking with multiple stakeholders, as well as the convening of conferences and workshops and dissemination of technical reports. Outreach and educational activities were conducted as a means of generating public support for the implementation of enforceable policies and programmatic measures for protecting submerged, intertidal, and estuarine coastal wetland resources.

Program changes and initiatives.

- The Coastal Zone Management program follows the principles used in the Island Wide Land use Plan (IWLUP), at the time it was adopted (1978); marine coastal zoning districts (MCD) were not included in the IWLUP. Zoning guidelines for submerged lands were designed to implement public policies for the sustainable use of marine resources. The guidelines provide a scientific and methodological basis for the comprehensive zoning of submerged lands; zoning districts were delineated and mapped in order to minimize use conflicts among stakeholders, user groups, and the public, and; to maximize the sustainability of marine space. A program change will be needed and proposed by PRCZMP-CMO to formally incorporate MCD as part of the enforceable policies of the coastal zone management program of Puerto Rico.
- PRCMP has not yet developed a restoration plan for tidal and intertidal wetlands and related ecosystems. Coastal and intertidal wetlands as well as offshore reef systems represent the “soft infrastructure” that acts as the first line of protection from storm surge and coastal flooding. Restoring and extending these protective ecosystems is, therefore, an important program change that is projected for the next 2011-2015 program cycle.
- PRCMP-CMO has completed the development of the marine and intertidal wetlands draft zoning documents. Zoning districts have not been adopted by the PRPB. However, CMO will use these results as the basis for the proposed Coastal and Marine Spatial process initiated by President Obama through President Obama’s Executive Order 13547 adopting the Task Force's report, defining a National Ocean Policy that prioritizes the protection, maintenance and restoration of ecosystem health and sustainable economic development of our coastal and ocean economies. Coastal and Marine Spatial Planning (CMSP) is the planning process established to achieve these

goals and the National Ocean Council and associated committees and regional planning bodies comprise the governance structure created to ensure implementation

Resource Characterization

Problems and opportunities with regard to the enhancement objective

1. Please indicate the extent, status, and trends of wetlands in the coastal zone using the following table:

Wetlands type	Estimated historic extent (acres)	Current extent (acres)	Trends in acres lost since 2006 (Net acres gained & lost)	Acres gained through voluntary mechanisms since 2006	Acres gained through mitigation since 2006	Year and source(s) of Data
Tidal (Great Lakes) vegetated	N/A	N/A	N/A	N/A	N/A	N/A
Tidal (Great Lakes) non-vegetated	N/A	N/A	N/A	N/A	N/A	N/A
Non-tidal/ freshwater	Not available	Not available	Not available	Not available	Not available	Not available
Other (please specify)	Not Available	217,118.00	Not available	Not available	Not available	

2. If information is not available to fill in the above table, provide a qualitative description of information requested, including wetlands status and trends, based on the best available information.

Total wetlands acreage from the inventory maps is 217,118.00 acres. Relevant information on the extent of protected wetlands in Puerto Rico before 2006 is included in the table. Actually, a total of 61,233.98 acres of wetlands are protected by federal and local government designations. The remaining 152,933.96 wetlands acreage is distributed along private properties, altered wetlands, or wetlands remaining in their natural condition. In order to make informed policy recommendations for other coastal regions, comprehensive data for specific coastal sub regions is needed.

Table 2: Coastal habitats protected by federal and local government designations

Designation	Estuarine (acres)	Lacustrine (acres)	Marine (acres)	Palustrine (acres)	Riverine (acres)
State Forest	7474.57	0	413.67	447.86	0
State Forest- Buffer zone	15.60	0	.33	0	0
Marine Reserve	49.01	0	96.16	447.83	0
National Estuarine Research Reserve	1244.29	0	9.26	161.59	0
Natural Reserve	769.09	0	26.19	1169.61	7.22
Natural Reserve- Buffer zone	0	0	0	0	0
Natural Reserve- Marine extension	2437.50	0	1718.67	0	0
Wild Life Refugee	578.59	31	0	1.11	0
Conservation Trust of Puerto Rico	3363.25	0	17215.31	862.95	11.65
US Fish and Wildlife Service	2545,56	0	317.51	.03	0
*DNER acquired properties (2)	2138.50	0	40.83	291.10	0
TOTAL	**25,496.01**	**31**	**35,306.03**	**3,382.13**	**18.87**

* To be designated

3 .Provide a brief explanation for trends

While coastal development has been a persistent trend, statistically significant data on wetlands loss is not presently being compiled due to the limited budget that is available. Assistance of other agencies will be needed if this information is to be systematically compiled.

4. Ongoing or planned efforts to develop monitoring programs

DNER has processed 270 cases related to wetlands since 2006 (Source: Joint Permit Application records). However, quantitative change data resulting from the Joint Permit Application Process and the Federal Consistency Certification Process is not compiled in a separate data base. Within budgetary limits DNER intends to continue increasing its capabilities for tracking project review and permitting actions, and relating the effects of permit approvals to the wetlands inventory.

5. Use the following table to characterize direct and indirect threats to coastal wetlands, both natural and man-made. If necessary, additional narrative can be provided below to describe threats.

Table 3: Threats to coastal wetlands

Type of threat	Severity of Impacts (H,M,L)	Geographic scope of Impacts (extensive or limited)	Irreversibility (H,M,L)
Development/Fill	H	Extensive	H
Alteration of hydrology	No systematic data	No systematic	H

		locational data but occurring in some agricultural areas adjacent to wetlands	
Erosion	M	Limited	H
Pollution	H	Extensive	H
Channelization	H	Extensive in riverine areas	H
Nuisance or exotic species	H iguanas, M alligators, H red lion fish	No systematic data	M
Freshwater input	M	No systematic location data but occurring in some agricultural areas adjacent to wetlands	H
Sea level rise	L (short-term); H (long-term)	Extensive along the entire coastal perimeter	H
Other (see notes below)	H	Extensive damage to submerged lands from multiple sources	H

Additional narrative:

- Sea level rise

Projected mean sea level rise for the north coast of PR has been calculated to average 2.3mm/yr, and 1.8 mm/yr for the south coast. The sea level trends are based on a 30-year record from La Puntilla (San Juan) and Magueyes Island (Lajas) tide gages. Using these projections, salinity impacts on selected estuaries and coastal freshwater habitats were forecast. A verified increase in salinity of a coastal lagoon was recorded in the Humacao Natural Reserve. DNER, in coordination with the USGS, EQB, SJBE, and university researchers, are continuing to monitor sea level rise in coastal waters.

While the threats resulting from sea level rise are not readily apparent, the long term implications of climate change and global warming are predicted to significantly raise sea level elevations in the coming decades. This is a recognized threat to ocean islands worldwide. Given the concentration of Puerto Rico's population, infrastructure, and economic activity in the coastal zone, the submerged lands, intertidal wetlands, and reef systems, in addition to their ecological value, play a vital function in providing the "soft infrastructure" that protects life and property by buffering inland areas from the impacts of storm surge and other coastal hazards.

The protection and extension of these natural systems is, therefore, of key strategic importance to the SPCWMR. Integrating these natural systems into the overall program will be a significant program change in the 2011-2015 cycles.

- Other

Port and marina maintenance, dredging, ship groundings, laying of submarine fiber optic cables, increased demand of boating activities, poor anchoring practices and commercial and recreational fisheries activities, pose growing threats to marine ecosystems. Today they represent only a few of existing multiple ocean uses

6. (CM) Indicate whether the Coastal Management Program (CMP) has a mapped inventory of the following habitat types in the coastal zone and the approximate time since it was developed or significantly updated

Table 4: Mapped habitat inventories in the Coastal Zone

Habitat type	**CMP has mapped inventory (Y or N)**	**Date completed or substantially updated**
Tidal Wetlands (a)	Y	1985
Beach and Dune (e)	Y	1982
Near shore (d)	Y	2000
Other (*)		

(a) The FWS wetland maps for the base year (1985).
(e) DNER Geo informatics Division (1982).
(d) NOAA's benthic mapping (2000).
(*) DNER Geo informatics division maintains an extensive inventory on the distribution of natural resources.

7. (CM) Use the table below to report information related coastal habitat restoration and protection. The purpose of this contextual measure is to describe trends in the restoration and protection of coastal habitat conducted by the State using non-CZM funds or non-Coastal and Estuarine Land Conservation Program (CELCP) funds. If data is not available to report for this contextual measure, please describe below actions the CMP is taking to develop a mechanism to collect the requested data.

Table 5 Trends in the restoration and protection of coastal habitats

Contextual measure	**Cumulative acres for 2004-2010**
Number of acres of coastal habitat restored using non-CZM or non-Coastal and Estuarine Land Conservation Program (CELCP) funds	No quantitative data
Number of acres of coastal habitat protected through acquisition or easement using non CZM or non-CELCP funds	(1) Military bases 2470.33 acres (2) Total wetlands 409 acres

(1)Military installations acquired through closing of U.S. Navy bases in Vieques and Ceiba.
(2) DNER's Natural Patrimony Division was created by Law 150 on Aug, 4, 1988 for the purpose of acquiring sensitive environmental areas for protection.

Wetlands acquisition: Since 2006 three properties with wetlands have been acquired.

- Finca Noya at Tortuguero (282 acres bought for $2.0 million)
- Finca Noya at Camuy (60 acres, appraised value around $3 million)
- Punta Tuna at Maunabo (67.2 acres expropriated value under litigation but valued at approximately $3.5 million)

Funding for acquisition was from non-CZM sources such as legislative assignments, royalties from the

Conservation Trust, and funds from compensatory actions required by DNER Regulation No. 25.

Management Characterization

1. Approaches in addressing problems.

The significant changes that have occurred for each management category since the last assessment are indicated below:

Table 5: Changes in use of management categories since last assessment

Management categories	**Employed by state/territory (Y/N)**	**Significant changes since last assessment (Y/N)**
Wetland regulatory program implementation, policies, and standards	Y	Y
Wetland protection policies and Standards	Y	Y
Wetland assessment methodologies (health, function, extent)	Y	No systematic data
Wetland restoration or enhancement Programs	Y	No systematic data
Wetland policies related public infrastructure funding	N	No systematic data
Wetland mitigation programs and policies	Y	No systematic data
Wetland creation programs and policies	N	No systematic data
Wetland acquisition programs	Y	No systematic data
Wetland mapping, GIS, and tracking Systems	Y	Y
Special Area Management Plans	Y	N (Conducted under Sec.306)
Wetland research and monitoring (Jobos NERR)	Y	Y (*)
Wetland education and outreach	Y	Y
Other	N/A	N/A

(*) Described in other performance report task.

2. Significant changes since the last assessment

a. Management categories:

Policy and program enhancements

- Ecosystem zoning

This work represents a significant change in enhancing program capabilities. It also provides a bridge for linking wetlands and submerged lands management to other priority program areas such as Ocean Resources and Coastal Hazards.

The experience gained as a result of the wetlands zoning effort provides the basis for identifying opportunities for incorporating submerged and intertidal wetlands into an overall strategic plan to protect Puerto Rico, and particularly its densely populated urban areas, from the threats posed by climate change and sea level rise. Accordingly, this is being proposed as an important component of the next Sec. 309 cycle. Results of program outputs will feed into the Sub Regional Coastal and Marine Spatial Process and proposed Regional Ocean Partnership processes initiated by Puerto Rico and the U.S. Virgin Islands

Implementation

- Zoning guidelines and zoning district delineation

The development of the methodology for ecosystem zoning and zoning district delineation also represents a significant change in enhancing CZM program capabilities. Fragmented ecosystems in submerged lands lying between marine protected areas have been identified and linked as submarine corridors. Using zoning districts as a planning tool to protect biodiversity also points a direction to comprehensive ecosystem-based ocean management. A plan for zoning the submerged lands along the south coast of Puerto Rico has been completed and presented to the DRNA Secretary for departmental approval. It will subsequently be submitted to the Planning Board as the basis for the adoption of marine zoning maps (consistent with the implementation of Regulation 17, chapter 4, section 25). It is noteworthy that this program initiative is also consistent with Presidential Executive Order 13457 of July 19, 2010. Zoning maps, although not officially adopted, can now be used to facilitate coastal zone management. The methodology for marine ecosystem identification, evaluation, and classification can now be adapted for use by stakeholders and governmental agencies to:

- Minimize adverse impacts in siting proposed activities
- Facilitate the permit evaluation process
- Minimize stakeholder conflicts
- Promote economic sustainability

- Adoption of Executive Order 2008-53

Creation of the Interagency Committee for the Protection of Wetlands. Participating agencies include: DNER, PRPB, Department of Agriculture, National Parks Company, Land Authority, State Police, and The Office of Municipal Affairs.

- Adoption of Executive Order 13547, the Task Force's report, defining a National Ocean

Policy that prioritizes the protection, maintenance and restoration of ecosystem health and sustainable economic development of our coastal and ocean economies. PRCMP will initially incorporate the principles of marine spatial planning and ecosystem-based management through Sub Regional Marine Spatial Planning Committees. key players in these committees will be integrated by Professional Planners from coastal municipalities, Scientific Advisors from Academic Institutions and intergovernmental agencies, along with identified stakeholders. At the same time, PRCMP will continue to work in coordination with

the Government of the U.S. Virgin Islands, the U.S. Fish and Wildlife Service, NOAA's National Marine Fisheries Service, PRPB, PREQB and DNER to develop the U.S. Caribbean Region Ocean Planning and Landscape Conservation Initiatives,

Wetland mapping

Wetlands mapping resulted in the delineation of 188 zoning districts on the south coast with the following proposed classifications: 88 districts were evaluated, classified and proposed for preservation; 48 districts were evaluated, classified and proposed for conservation and 52 districts were evaluated, classified and proposed for mangrove protection.

In fulfillment of a legislative mandate required by Law 314, a wetlands inventory was completed that identified candidate areas for natural reserve designation. A Report and Atlas of the geographic distribution is posted on DNER's web page.

Wetland Education and outreach

Conferences

• The first Conference on Coastal and Marine Spatial Planning was hosted by the PRCMP in 2010. First round of conferences on Marine Space: the conference agenda focused on submerged lands. Over 200 people participated at the First Marine Spatial Planning Symposium. Representatives from different environmental groups, academic institutions, intergovernmental agencies and stakeholders participated at this event. Thirty five (35) abstracts were received and relevant presentations were selected. The symposium was held at the DNER Auditorium. More information is available at:
http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/costasreservasrefugios/pmzc/primer-simposio-de-planificacion-y-manejo-de-los-terrenos-sumergidos

Presentations:

• Managing the Submerged Lands of Puerto Rico, presentation at the 25th International Submerged Lands Conference, New Jersey, New York, 2006; presentation at the Fourth Forum of the Guilarte Forest, Bosque Estatal de Maricao, DNER, Maricao, PR, 2006; First Natural Resources Symposium, poster session DNER, San Juan PR, 2007.

• Underwater corridors as an option to avoid the fragmentation of marine natural habitats, presentation at the Association of American Geographers Annual meeting, Boston, Massachusetts, 2008; poster session. Coral Reef Conference, DNER, San Juan, PR, 2008; presentation at the Puerto Rico University , Geography Department Río Piedras, PR, 2008.

• CMO Staff participation at the National Conference on Geographic Education, "Crossroad of Culture". National Council for Geographic Education. San Juan Puerto Rico, 2009. Distribution of posters about the riverine ecosystems of Puerto Rico.

• Puerto Rico: the Integration of Marine Spatial Planning to Coastal Zone Management, presentation at the First Marine Spatial Planning Conference. DNER, San Juan, PR, 2010.

Workshops:

- Local Review of Coastal Wetlands. This intergovernmental workshop was convened by DNER CMO staff, and was attended by the planning offices of 22 coastal municipalities. Hotel Sheraton San Juan, PR, 2008.

- Zoning Submerged Lands: a workshop. Catholic University, Environmental Science Department, Ponce, PR, 2009; Interamerican University, Law School. Hato Rey, PR, 2007 ; The PR Annual Boat show, Convention Center, Hato Rey, PR, 2006.

Technical reports:

Geographical distribution of candidate wetland areas for natural reserve designation. Local review of wetlands: Final Report. Atlas: Maps for the local review of wetlands. Strategic Plan for the Conservation, Management, and Restoration of Coastal Wetlands: First draft. Zoning guidelines for the submerged lands of Puerto Rico. Marine spatial plan for the submerged lands of the south east coast of Puerto Rico.

Educational outreach:

Permanent exhibit of marine zoning maps in natural reserves along Arecibo, Cabo Rojo, Guayama, Fajardo, and San Juan for general public use. Brochure distribution to stakeholder's about the Integration of Marine Spatial Planning to Coastal Zone Management.

b. Cost

PRCMP 309 funds were used to support all wetland education and outreach activities.

c. Outcomes and effectiveness of changes

Building on the accomplishments of the 2006-2010 enhancement program, the 2011-2015 wetlands enhancement program incorporates activities that:

- Promote the planning and management of wetlands and submerged ecosystems (coral reefs and sea grass beds) as vital defensive measures to protect life and property against the consequences of climate change and sea level rise.
- Key natural systems, such as coral reefs, intertidal wetlands and other geomorphic features, function as physical barriers providing protection to coastal communities. Devising measures to protect enhance and extend these protective features, through both natural and artificial means will be a major program focus.
- Wetlands and submerged lands zoning is a key program enhancement activity that will be expanded from the south coast to other coastal sub-regions. Interagency consultation and coordination will be on-going to affect Planning Board endorsement of the zoning recommendations.
- Results of program outputs will feed into the Sub Regional Coastal and Marine Spatial Process and proposed Regional Ocean Partnership processes initiated by Puerto Rico and the U.S. Virgin Islands

Other projected program activities include:

- Elaboration of the strategic plan for coastal wetland management and restoration (SPCWMR) as a component of the sub-regional marine spatial plan for Puerto Rico.
- Preparation of status report on intergovernmental and stakeholders workshops related to the south-east coast submerged lands plan.(First Phase)
- Preparation of status report on intergovernmental and stakeholders workshops related to the north-west coast submerged lands plan (Second phase)
- Technical report of the sub-regional marine spatial plan for Puerto Rico (Third phase).
- Creation of an MSP web data center to track effectiveness of management measures and promote wetland educational activities.

The effectiveness of the zoning district proposals in affecting governmental decision-making remains to be evaluated. Efforts to have the guidelines and the methodology for zoning district delineation adopted by the Planning Board will continue during the next program cycle, as will the continuation of the planning process for other coastal sub-regions of Puerto Rico.

It is notable that the decision to pursue a program of zoning of submerged lands is consistent with new federal initiatives related to Ocean and Marine Spatial Planning and with the Presidential executive order 12345 of July 19 ,2010. That EO proposes a comprehensive ecosystem based approach to National Ocean, Coastal, and Great Lakes policy.

The Puerto Rico CMP is developing a multilayered strategy in which the wetlands component of the Sec. 309 program will focus on wetlands protection, preservation, restroration, and expansion of wetlands and related submerged ecosystems (sea grass beds and coral reefs). The dual objective will be ecosystem protection and the use of these systems to minimize the socio-economic and physical impacts of sea level rise and coastal hazards as a result of climate change.

It is anticipated that the approach and results of this effort will, at some point, contribute to, and be integrated into, a Puerto Rico/Caribbean MSP Region Plan Draft.

3. Habitat restoration

Habitat type	CMP has a restoration plan (Y or N)	Date completed or substantially updated
Tidal(GreatLakes) Wetlands	N	N
Beach and Dune	N	N
Nearshore	N	N
Other (please specify)	N/A	N/A

PRCMP has not yet developed a restoration plan for tidal and intertidal wetlands and related ecosystems. Restoration measures will be pursued during the 2011-2015 program cycle as a key element in integrating these systems into the Puerto Rico Coastal Zone Management Program.

As previously noted, coastal and intertidal wetlands together with offshore reef systems represent the “soft infrastructure” that acts as the first line of protection from storm surge and coastal flooding.

Proposing public policy to increase protection of these ecosystems is, therefore, an important program change that is projected for the next program cycle.

Among the activities that will be undertaken as part of this effort are:

- Review maps of ecosystems components.
- Prepare overlays / maps to investigate relationships between individual wetland components.
- Implement GIS-based procedures to generate maps to identify protection and restoration priorities
- Designate multiuse zoning districts

Priority needs and information gaps

Table 6: Priority needs and information gaps

Gap or need description	Type of need (regulatory, policy, data, communication and outreach)	Level of priority (h,m.l)
Benthic and wetland habitat characteristics and conditions	In order to make informed policy recommendations and develop multilayered strategic zoning districts for other coastal regions, comprehensive data for specific coastal sub regions is needed.	H
Integrate conservation and preservation districts as part of the overall program for soft infrastructure protection.	Policy basis exists for ecosystem protection; zoning regulations need to be extended to submerged lands. A great deal of inter-agency collaboration, particularly between DNER/CMO and PB staff will be required to implement effective and enforceable policies and measures.	H
Tracking of Wetland loss and gain.	Improved monitoring of permit conditions. Erosion and sedimentation control fill activities, anchoring, etc. Training for Rangers to identify and report violations. Cost benefit assessment of restoration methods and options for wetlands and related ecosystems.	M
Comprehensive Plan for the Management and Restoration of Coastal Wetlands	Identify potential, feasible mechanisms. Develop guidelines considering institutional issues with respect to agency roles and responsibilities for wetland protection, restoration and mitigation. Integration into the Puerto Rico/Caribbean MSP Region Plan Draft and the Coastal Hazard Management	H

	program.	
Outreach	See Note Below	L

Note: Outreach and communication
DNER has consolidated its public education and community outreach resources under an Assistant Secretariat for Information and Education. While some outreach activities will be undertaken, similar to those performed in the 2006-2010 program cycle, the preponderance of this work will be conducted and/or coordinated through the 306 program.

The strategy for the wetlands component addresses the following needs:

- Promote the conservation of wetlands through sustainable development activities.
- Improve interagency coordination including the coordination of the implementation of erosion and sediment control requirements on agricultural lands by the PRPB and EQB.
- Provide guidelines and seek Joint Permit regulations amendments geared to protect wetlands ecologic and coastal hazards amelioration values and functions.
- Development of coastal habitat restoration strategies and monitoring plans

Enhancement area prioritization

1. Priority ranking
The wetlands enhancement area is rated High priority for both Sec. 309 funding as well as for other aspects of the PR CZM Program, and by the public response to the survey conducted by the DNER in formulating the 2011-2015 Sec. 309 strategies.

High X
Medium
Low

2. Justification for priority ranking

Providing coastal protection:
Wetlands as well as reef systems represent an essential, low cost means of providing natural, low-impact infrastructure to minimize loss of life and property damage from climate change and sea level rise. Coastal and intertidal wetlands together with reef systems and other marine ecosystems offer the first line of defense against inland flooding from storm surge and hurricane driven waves from severe weather events.

Need to counter continuing threats to marine ecosystems:
Maintenance dredging of ports and marina facilities, ship groundings, laying of submarine cables, bad anchoring practices and commercial and recreational fisheries activities continue to pose significant threats to marine ecosystems along the coastal perimeter and in submerged lands within PR territorial waters.

Protecting coastal water quality:
Wetlands and marine vegetation filter sediments and other pollutants originating in upland areas and draining to the sea through nonpoint source runoff and through river and stream flow. The destruction of these critical ecosystems represents an increased threat to coastal water quality, with potential impacts

COASTAL HAZARDS ASSESSMENT

Section 309 Enhancement Objective

Prevent or significantly reduce threats to life and property by reducing and eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential climate changes.

Summary of 2006-2010 Program Accomplishments

Significant accomplishments were made in the Coastal Hazards enhancement program during the 2006-2010 Sec. 309 cycle. PRCMP led the effort to collect important data and information to support modeling efforts to be used in coastal vulnerability assessments and formulating adaptation strategies (to be undertaken in the 2011-2015 program cycle). LIDAR imagery, updated aerial photography (2007) were partially funded by PRCMP. PRCMP strengthened partnerships with the Caribbean Coastal Ocean Observing Systems, Caribbean Tsunami Center, Puerto Rico Coastal Hazards Center and the Puerto Rico Seismic Network in an effort to improve knowledge about coastal hazards and potential impacts of climate variability and change on Puerto Rico's coastal zone.

PRCMP funded a study to assess the role of coastal geomorphic features, such as sand dunes, in protecting coastal communities from coastal inundations. In coordination with CARICOOS, PRCMP -CMO RS-GIS unit modeled storm surge projections and potential impacts on coastal areas. The ADCIRC Coastal Circulation and Storm Surge model was coupled with the SWAN spectral wave model and Cornell University Long and Intermediate Wave Modeling Package (COULWAVE) models to produce potential scenarios of storm surge inundation using different hurricane categories, barometric pressures and winds as well as four different angles of surge penetration. PRCMP funded a public perception survey of climate change and coastal hazards for eight coastal municipalities located on the west coast of Puerto Rico. PRCMP used this information to raise the awareness of the public and of decision makers about coastal hazards, and to facilitate policy adjustments for incorporation in the updated draft of the PRCMP.

CMO has been highly involved in policy design, modeling, and planning to promote coastal hazards resiliency. During the past years, PRCMP has supported modeling efforts to identify areas potentially vulnerable to sea level rise, storm surges and coastal floods. PRCMP has also supported studies that enable the identification of natural coastal features that provide coastal communities protection from hazards. In addition, studies in support of MTZ delineation are also useful to support CMO, PRPB and FEMA's policy making processes regarding coastal hazards amelioration.

PRCMP has a vision of a safe, healthy, productive, sustainable, and resilient Puerto Rico. In order to achieve this vision CMO has initiated the:

(1) Analysis of risk and vulnerability, as a basis for devising structural and nonstructural options to mitigate threats from coastal hazards.

(2) Networking and interagency collaboration since multiple agencies, both local and federal, are involved in hazard mitigation activities; this requires that the CMO function within a complex institutional framework if its recommendations for policy and program changes are to be adopted.

(3) Education and outreach. Developing public understanding and support for the adoption of remedial actions including new policy initiatives, changes in land use controls, and adoption of more hazard-resistant building design measures.

CMO will update progress on these three areas at all future reports. CMO will also report on coordination with relevant top level decision makers at DNER, PRPB, OGPe, Emergency Management Agency and representatives of the Governor's office who need to be involved in the review of issues and policy directions proposed under PRCMP initiatives. The resolution of coastal hazard vulnerability issues go well beyond technical considerations. Without senior level involvement and support, technical staff will find it difficult to move PRCMP recommendations to the implementation stage.

Summary of 2011-2015 Program Focus

The work conducted during the 2006-2010 funding cycle prepared PRCMP to undertake a major challenge: the Assessment of Puerto Rico's Coastal Zone Vulnerability to Climate Change and Sea Level Rise. During 2011-2015, PRCMP will finalize the coastal zone vulnerability assessment . The vulnerability assessment will serve as the basis for the development of sectoral adaptation strategies in coordination with staff professionals, scientists, and researchers from the universities of Puerto Rico (UPR-M, UPR-RP, UPR-CM, UPR-C, UMET, University of Turabo, Interamerican University), the International Institute of Tropical Forestry, USGS, USFWS, NOAA-NMFS, NOAA-NWS, USEPA, CARICOOS, CCRI, the San Juan Bay Estuary Program, JBNERR. The vulnerability assessment and adaptation strategies will be used to promote policy, regulatory, planning and building code adaptations.

Resource Characterization

Problems and opportunities with regard to the enhancement objective.

1. Level of risk from coastal hazards

(Risk is defined as: "the estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." *Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA* 386-2. *August 2001)*

Table 1: Hazard types and risk levels

Type of Hazard	**General Level of Risk (H, M, L)**	**Geographic Scope of Risk (Coast-wide, Sub-region)**
Flooding	H	Coasts-wide
Coastal storms, including	H	Coasts-wide

associated storm surge		
Geological hazards (e.g. tsunamis, earthquakes)	L	Coasts-wide
Shoreline erosion (including bluff and dune erosion)	H	Sub-regions
Sea level rise and other climate change impacts	L (short-term); H (long-term)	Sub-regions
Land subsidence	L	Sub-regions

2. Discussion of high risk hazards

High susceptibility to coastal and riverine flooding.

The topography and location of communities in low lying drainage areas, along river floodways, and in coastal flood plains increases their vulnerability to loss of life and property damage during significant rainfall events. Many of the coastal communities most vulnerable to extreme rainfall events are located adjacent to rivers that originate in the central mountain range, carry runoff from large watersheds and discharge to the sea. Extensive areas of the coast are subject to storm surge generated by tropical storms and hurricanes. The greatest danger of flooding is that these events affect large areas of the coastal plain. Vulnerability to flooding has increased over past decades due to poor land use practices. Likewise, removal of vegetation in the upper reaches of watersheds has contributed to soil erosion, resulting in high sedimentation loads in water bodies. Sediment deposition has had the effect of reducing in-stream storage capacity during periods of high rainfall, thus aggravating flooding. Loss of vegetation and reduced infiltration of surface runoff as a result of building coverage and the use of impermeable materials has contributed to storm damage potential from high intensity rainfall events. Flooding is a frequent occurrence in Puerto Rico, often affecting highly developed and populated areas with resulting damage to private property and public infrastructure.

DNER/CMO was involved in the delineation and interpretation of the new FEMA flood maps in 2007. The public review was conducted in 2008 and final adoption in 2009.The National Flood Insurance Rate Maps (FIRMs) prepared by FEMA represent the primary information source for delineating coastal areas subject to flooding. By overlaying the FEMA maps on existing aerial photography and projected land use maps, affected communities can be identified, and approximations of risk and vulnerability can be extrapolated.

Coastal storms, including associated storm surge

Large areas of the coast are subject to the impacts of storm surge generated by the passage of weather events. Storm surge has the effect of causing coastal erosion and destruction. Storm surge impacts are most severe in the south and east coasts due to the shallowness of the seabed and the west-northwest path of most hurricanes. Vulnerability to storm surge has increased due to poor land use practices. The elimination of coastal wetlands exacerbates this situation, since wetlands reduce storm surge impacts and during high rainfall events, wetlands reduce rates of runoff and retain surface flow, moderating flood risk.

In February 1992 the National Hurricane Center prepared the Storm Surge Atlas that mapped high velocity wave areas. The Coastal Hazards Center at the University of Puerto Rico is currently preparing a study, funded by a research grant from Sea Grant, that includes storm surge elevations associated with Category 1, 3, and 5 hurricanes. The study will assess the extent of exposure of coastal infrastructure to hurricane wind-forced surface gravity waves in the most important bays, ports, and harbors for Puerto Rico and the US Virgin Islands

Shoreline erosion (including bluff and dune erosion)

Many factors cause shoreline changes on beaches around Puerto Rico: (1) human activities such as sand extraction, dams, and the presence of coastal structures; (2) lack of sand deposits in the near-shore area; (3) variability in the wave regime; (4) flood events of all magnitudes and frequencies; (5) the presence of submarine canyons; and (6) increase in tropical storm occurrence in the vicinity of the island. An analysis of coastal erosion and accretion had been carried out to verify the conclusions of a study of erosion rates based on historic aerial photographs. It had been anticipated that the analysis would provide the basis for a regulation by the Planning Board related to setbacks from the Maritime Zone. However, the results of the study were not supportive of a long-term erosion rate for the Island. Coastal erosion occurs in many parts of Puerto Rico. However, in coastal areas such as the shores of Guajataca and parts of Old San Juan, erosion rates are practically zero. Meanwhile, other beaches, such as in Loiza and Rincon, have been narrowing due to erosion. The process of coastal erosion can cause serious damage to terrain and structures. Some of the damage includes loss of the fertile layers of soil, loss of recreational value of some beaches and the undermining of buildings, houses, bridges, and roads. The magnitude of damage elevates this hazard to one of high risk.

3. Change in levels of risk since the last assessment

Sea level rise is considered a medium risk here due to low risk for short term and high risk for long term which is based on recent projects conducted in Puerto Rico and around the nation. However, there is growing concern about the increasing vulnerability of coastal communities to other hazards such as coastal flooding, erosion, and storms. Sea level rise is not yet acknowledged in Commonwealth plans as a hazard due to the fact that there is no island-wide risk and vulnerability assessment for climate variability and change on which to base this conclusion.

4. Ongoing or planned efforts to develop quantitative measures of risk for identified hazards

PRCMP funded a study to identify natural coastal features providing protection to coastal communities. The study conducted for 6 sites quantified erosion rates and correlated them to storm surges and winter swell waves. The study provided management recommendations to identify hazards and protect life and property at coastal communities.

5. Mapped inventory of areas affected by coastal hazards

The table below identifies the number of communities in the coastal zone that have a mapped inventory of areas affected by coastal hazards. Where data is not available for this contextual measure, actions that the PRCMP is taking to develop a mechanism to collect the data are described

Table 2: Communities with mapped areas of risk

Type of hazard	**Number of communities that have a mapped Inventory***	**Date completed or substantially updated**
Flooding	3	2007 FEMA Revised FIRMS
Storm surge	44/44	In progress by the Coastal Hazards Center of Puerto Rico (including SPOT storm surge elevations associated with Cat 1, 3, and 5 hurricanes)
Geological hazards (including earthquakes and Tsunamis)	0/44	DNER has GIS layers for earthquakes between 1824-1995 and 1989-2001. The Puerto Rico Seismic Network and the Caribbean Tsunami Center are conducting Tsunami (potential impact) studies and lead the Tsunami ready program.
Shoreline erosion (including bluff and dune erosion)	6/46	A study was funded by PRCMP to identify erosion rates ate selected sites of Puerto Rico. Final report was submitted to CMO and will be released May 2011. The Coastal Hazards Center of Puerto Rico is preparing a report on coastal inundation and erosion.
Sea level rise	5**/44	First study 2007 by Karst NGO. PRCMP funded modeling efforts that resulted in inundation maps (Cat 2 hurricane and 45 MPH winds) as well as a 1 meter sea level rise projection using the best bathymetry-coastal relief
Great lake level fluctuation	N/A	
Land subsidence	0/44	
Other (please specify)		

*A *community* is a unit of local government, local governmental organization, or special unit of government (i.e. coastal municipalities). There are 44 coastal municipalities total. Puerto Rico has

three FEMA communities, those that are autonomous municipalities (Puerto Rico Island, Ponce, Bayamon)
** Arecibo, Mayagüez, Ponce, Salinas and San Juan

Management Characterization

Effectiveness of management efforts to address those problems described in the above section.

1. Significant changes in management categories that have occurred since the last assessment

Table 3: Change in use of management categories since last assessment

Management categories ,	**Employed by state/territory** (Y or N)	**Significant changes since last assessment** (Y or N)
Building setbacks/ restrictions	Y	N
Methodologies for determining setbacks	Y	N
Repair/rebuilding restrictions	Y	N
Restriction of hard shoreline protection' Structures	Y	N
Promotion of alternative shoreline stabilization methodologies	N	N
Renovation of shoreline protection Structures	N	N
Beach/dune protection (other than setbacks)	Y*	N
Permit compliance	Y	N
Sediment management plans	Y**	N
Repetitive flood loss policies, (e.g., relocation, buyouts)	N	N
Local hazards mitigation planning	Y	N
Local post-disaster redevelopment plans	N	N
Real estate sales disclosure requirements	N	N
Restrictions on publicly funded Infrastructure	N	N
Climate change planning and adaptation Strategies	N	N
Special Area Management Plans	Y	N
Hazards research and monitoring	Y	Y
Hazards education and outreach	Y	N
Other (please specify)		

* *There exist some restoration projects for beach/dune protection*
** *Project-specific by the Army Corps of Engineers and DNER under NEPA compliance*

2. There have been significant changes since the last assessment for the management categories, “hazards research and monitoring” and slight changes for “hazards education and outreach”.

   Hazards Research and Monitoring

   The Caribbean Regional Association (CaRA) and the University of Puerto Rico – Mayaguez have jointly established the Alliance for Numerical Modeling and Coastal Forecast. The PRCMP contracted the Alliance to perform Coastal Zone inundation modeling using ADCIRC, SWAN and COULWAVE for all storm categories (1-5). This was partially funded through Section 309 funds. Additionally, the Alliance has improved their modeling of coastal winds, coastal waves, coastal currents, and offshore currents. These efforts are partially funded by non-309 funds of the CZMP.

   New tide gauges have been installed or planned for the future through CaRA and important sea level rise trends calculated using data from the preexisting gauges. For example, using the San Juan tidal gauge data from 1962 to 2010 Dr. Jorge Capella was able to calculate the current trend to be a sea level rise of 0.414 meters by the year 2100. Similarly, the Magueyes tidal gauge data from 1955-2008 shows a sea level rise trend of 0.256 meters by 2100. The tide gauges and data analyses were driven by non-CZM funds but are a result of CZM discussions. The improvements made in hazards research and monitoring since the last assessment and the improvements expected to be made in the next five years will greatly increase the Commonwealth’s ability to protect our coastlines.

   Hazards Education and Outreach

   Numerous efforts have been made since the last assessment to improve hazards education and outreach, however, more initiatives are needed to consider this a significant change in management. In September 2009 a 309-funded study was released through the work of Dr. Walter Diaz of *el Centro de Investigacion Social Asociada del Recinto de Mayaguez.* The study was titled, “*Percepcion sobre Riesgos Costeros y Cambio Climatico en el Area Oeste de Puerto Rico” (*In English: Coastal Hazards and Climate Change Perception in the Western Area of Puerto Rico). The study interviewed 600 people. The most important results of this study showed that a substantial majority of respondents perceive threats like storm surge flooding, sea level rise, and global warming, to be a real risk to themselves and their homes. Additionally, with the exception of landslides and river floods, the people interviewed, on average, believe the threats are probably or very likely to occur with the next ten years (20 years for rising sea levels and coastal erosion). People were asked to rank six public issues in order of importance to them. The top three were public health, education and crime. Interestingly, global warming was listed more important than government corruption and political status. And results of this study found that 47.17% of respondents felt that global warming is greater than or wholly caused by human actions, while 37.2% indicated that it is completely or mostly natural in origin. It is important to note that only 8.7% indicated that global warming is “completely natural”. In other words, for almost 76% of respondents human activity is a factor or cause of global warming. There was a high percentage (15.67%) of respondents that claimed they did not have an opinion on this question. Most of these cases related to people with less formal education.

In addition to this study, the CMO has released several publications that highlight research needs for sea level rise and climate change, such as the 25th Anniversary of the Coastal Zone Management Program that was released in 2005. Additionally the CMO is frequently invited to speak at events across the island on these subjects.

Non-CZM efforts for hazards education and outreach have started being conducted on an on-going basis since the last assessment. These include efforts by the Puerto Rico Seismic Network, specifically educating residents and municipal planners and emergency managers about earthquakes and tsunamis; Sea Grant Puerto Rico is educating on numerous hazards such as climate change, tsunamis, rip currents (in terms of beach safety), storm surges, and erosion.

2. (CM) Communities in the coastal zone that use setbacks, buffers, or land use policies to direct development away from areas vulnerable to coastal hazards

Where data is not available, the CMP is taking action to develop a mechanism to collect the requested data (described below).

Table 4: Communities covered by hazard management policies and plans

Contextual measure	**Number of communities**
Number of communities in the coastal zone that are required to develop and implement land use policies to direct development away from hazardous areas that are approved by the state through local comprehensive management plans.	44 municipalities
Number of communities that have approved state comprehensive management plans that contain land use policies to direct development away from hazardous areas. .	0

Priority Needs and Information Gaps

The following table identifies major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing each of the enhancement area objectives that could be addressed through the CMP and partners (not limited to those items to be addressed through the Section 309 Strategy). Where necessary, additional narrative describes major gaps or needs.

Table 5: Priority needs and information gaps

Gap or need description	**Type of gap or need (regulatory, policy, data, training, capacity, communication & outreach)**	**Level of priority (H,M,L)**
Management gaps	Regulatory/policy gaps: beach/dune/geomorphic feature protection; promotion	High

	of alternative shoreline stabilization methods; real estate sales disclosure requirements; local post-disaster redevelopment plans; climate change planning and adaptation strategies	
Vulnerability assessments for climate variability and change, such as sea level rise, implications on hazards	Data: currently no Commonwealth-wide risk and vulnerability set exists for sea level rise and other climate change-related impacts. Because of this, it is difficult to encourage local governments and other agencies to integrate possible future climate conditions (i.e. sea level rise) into their plans. Policy/Capacity: Also needed in order to address SLR as a hazard in the Commonwealth Hazard Mitigation Plan and other government agency plans	High
Institutional arrangement to support inter-Agency collaboration and coordination	Capacity:Institutional issues with respect to agency roles and responsibilities could impede program success. A great deal of inter-agency collaboration, particularly between DNER/CMO and PB staff will be required to formulate and implement effective and enforceable policies and measures. Additionally, at key points the top levels of DNER, PB, and representatives of the Governor's office will need to be involved in the review of issues and policy directions since the resolution of coastal hazard vulnerability issues go well beyond technical considerations. Without senior level involvement and support, technical staff will find it	High

	difficult to move program recommendations to the implementation stage.	
Comprehensive data and mapping for coastal hazards and geomorphic features	Data: In order to make informed policy recommendations and develop effective hazard mitigation projects comprehensive data on multiple hazards (both acute and chronic) is needed (i.e. storm surges, flooding, erosion, sea level rise). Specifically, accurate maps of high risk areas, completion of the Puerto Rico Vertical Datum 2002, and coast-wide data sets. Also needed is a GIS database of key geomorphic features and wetlands that provide protection to coastal communities from natural hazards.	High
An island-wide adaptation strategy	Data/Regulatory/Policy/Communications and Outreach: This collaborative document will use the vulnerability analyses to identify potential, feasible mechanisms for adures, and private sector and civil society actions for Puerto Rico. It is anticipated that this strategy will identify other Potential future gaps	High
Design standards for natural and man-made features in areas subject to coastal flooding	Training/Guidance: New or revised regulations and guidelines regarding building setbacks and design elevations for private and public infrastructure development in coastal high hazard areas	High
Climate change awareness, understanding, and interest within the public and private sectors	Communication and Outreach: Need communication and outreach on the topic and capacity building within and between agencies	High

Enhancement Area Prioritization

1. Priority ranking of the enhancement area (including, but not limited to CZMA funding)

High	_X_
Medium	_____
Low	_____

2. Justification of priority ranking

During recent decades there has been an increase in the demand for space in coastal lands to construct second homes and tourism related facilities. Many shoreline hardening structures, groins, and breakwaters affected littoral processes increasing vulnerability and coastal communities exposure to coastal hazards. Activities in the upper reaches of river basins also have an impact on erosion changing the sedimentation patterns in the coast by reducing sediment inputs into the system.

In Puerto Rico there are 8,431 hectares classified as coastal barriers, located principally in the southwest and northeast. These are fragile coastal areas and natural systems vulnerable to increasing sea level rise and exposure to storms, floods, and other natural hazards. Coastal hazard policies are an integral part of the PRCZMP. However, there is a need to further define specific policies and management strategies to address current and potential impacts associated with climate change, sea level rise, and associated coastal hazards in light of new knowledge and model projections.

A local NGO, *Cuidadanos del Karso*¸ commissioned a study to estimate the potential impact of rising sea levels on five municipalities in Puerto Rico. By modeling three different scenarios (1m, 2m, and 3m SLR) it was found that major infrastructure such as flood control projects, ports and marinas, major roads, the international airport, agriculture, aquifers, and communications infrastructure is threatened. Given the significant threat posed by coastal hazards and climate variability and the resulting need for promoting community resiliency, this enhancement area is considered a high priority.

3. The CMP intends to develop one or more strategies for this enhancement area

Projected sea level rise impacts threaten to greatly exacerbate the vulnerability of Puerto Rico's already at-risk coastal resources. Also, FEMA approved the Commonwealth Multi-Hazard Mitigation Plan, and local mitigation strategies do not address sea level rise. There is a need to advance sea level rise adaptation and vulnerability analyses through action at the Commonwealth and local level. An assessment and strategy will be developed that will lay a foundation for integrating SLR adaptation into Puerto Rico's land use planning framework and for identifying SLR as an issue that affects hazards in future mitigation plans. A model for simulating future SLR and coastal hazard impacts will be identified and guidance will be developed for all levels of government and PR society to incorporate hazard data into local plans, regulations, projects, policies, special area management plans, and post-disaster hazard mitigation plans.

PUBLIC ACCESS ASSESSMENT

Section 309 Enhancement Objective

Attain increased opportunities for public access, taking into account current and future public access needs to coastal areas of recreational, historical, aesthetic, ecological or cultural value.

Summary of 2006-2010 Program Accomplishments

During the 2006-2010 Sec. 309 cycle there were significant program enhancement accomplishments. These included devising procedures for identifying and evaluating coastal access sites, networking with local and Commonwealth agencies in conducting an island-wide signage program, implementing enforceable policies with respect to public access objectives, conducting outreach activities targeted to local government, and strengthening program effectiveness through Collaborative Agreements (MOUs) with coastal municipalities. Principal activities and milestones are specified below as indicative of program accomplishments.

- Under the Sec. 309 Public Access program, PRCZMP played a major role in the Coastal Areas Sites Signage System leveraging 309 funding by partnering with the Commonwealth Dept. of Transportation thereby augmenting financing for signage installation.
- To facilitate the identification and characterization of coastal access sites aerial and field surveys were undertaken in all coastal sectors, including most recently in the southwest segment covering the municipalities of Guayama, Salinas, Santa Isabel, Juana Diaz, Ponce, Peñuelas, Guayanilla, Yauco, Guánica and Lajas. Public awareness of access rights-of–way has been significantly increased by the signage program implemented under the Sec. 309 program.
- To provide local communities with relevant information on access opportunities, Coastal Access Guides were prepared and distributed for the municipalities of ofIsabela, Quebradillas, Camuy, Hatillo, Arecibo, Barceloneta, Manati, Vega Baja, Vega Alta, Dorado, Toa Baja, Cataño, San Juan, Carolina, Loiza, Rio Grande, Luquillo, Fajardo, Ceiba, Naguabo, Humacao, Yabucoa, Maunabo, Patillas, and Arroyo.
- Draft agreements were presented to each of the forty four (44) coastal municipalities. DNER through PRCMP-CMO offered technical assistance and guidance to improve public access, public access rights and reduce public access reduce legal or physical barriers impeding, reducing or limiting public access to the coast.
- DNER has signed coordination agreements with the municipalities of Isabela, Toa Baja, Barceloneta, Ceiba and Patillas. Follow up meetings have been conducted or are programmed for the rest of the municipalities that have not signed the agreements. This model will be replicated with other communities over time, significantly strengthening program objectives by mobilizing local involvement in monitoring illegal attempts to restrict public coastal access.

Summary of Future Activity Focus

Building on the accomplishments of the successive Sec. 309 program enhancement cycle, future CZM activities with respect to public access will be integrated into the Sec. 306 program, focusing on the following :

- Fostering urban waterfront park acquisition though post-disaster hazard mitigation planning and Sec. 1362 of the Federal Flood Insurance Program to promote public access while simultaneously reducing disaster vulnerability;
- Encouraging the incorporation of coastal parks and promenades into community plans providing public access at the community level while protecting upland areas from storm surge and other coastal hazards;
- Strengthening community resilience in confronting the potential impacts of climate change by using coastal parks and open space as protective infrastructure from coastal hazards.

Projected Sec. 306 program activities will include: The systematic assessment of urban waterfronts and small boat harbors in non-metropolitan coastal municipios; identification of opportunities for the development and/or enhancement of waterfront parks for both public access and as protection against coastal hazards, and; selecting one or more pilot municipios, demonstrating how regulatory and programmatic measures can be used to acquire, improve, and maintain public access sites to meet current and future demand.

Technical assistance to coastal municipalities will be the principal means of accomplishing these objectives under the regular 306 program. It is anticipated that project implementation will be vested at the local level with planning and project concurrence from the Planning Board and involvement of other commonwealth and federal agencies as appropriate.

This evolution in program direction will significantly broaden the CZM program by: (1) the addition of an urban focus in coastal access, and; (2) utilization of coastal parks as “soft infrastructure” for protection against coastal hazards.

Resource Characterization

Problems and opportunities with regard to the enhancement objective.

1. Threats and conflicts affecting public access in the coastal zone

Table 1: Threats and conflicts

Type of threat or conflict causing loss of access	**Degree of threat (H M L)**	**Description of trends and/or statistics that characterize the threats and resultant impacts on coastal access**	**Type(s) of access affected**
Private residential development (including conversion of public facilities to private use)	M	Residential shorefront development on the main island has slowed significantly due to the economic recession. The two exceptions are Vieques and Culebra where	Public access continues to be constrained due to limitations on vehicular parking, and the absence of facilities at outlying beach locations. Gated communities in urban

		second home and retirement homes are being constructed in coastal locations.	areas also act to discourage public access.
Non-water dependent commercial/industrial uses of the waterfront (existing or conversion)	M	Over the long-term, waterfront industrial use is being replaced by hotel and condominium development. Near-term, all waterfront development is in a downturn due to credit and other financial constraints to new development. Mayaguez and Aguadilla have initiated major waterfront development projects. But few changes have occurred in most non-metropolitan coastal municipalities.	The net effect of the displacement of waterfront commercial/industrial use by residential and open space uses has been to increase opportunities for public access, although on a limited scale since provision for public access is generally a low priority in the reuse conversion process.
Erosion	M	This is a localized problem resulting from storm events and oceanographic conditions.	Not a significant island-wide impediment to access. However, localized shoreline impacts can be severe.
Sea level rise	L	No near-term evidence, but significant long-term potential threat.	Poses a long-term threat to beach and coastal recreational uses and to shorefront properties.
Natural disasters	H	Major threat to coastal communities and to regional beach recreational facilities with potentially severe economic impacts on tourism sector.	Result in destruction of public beach facilities, piers and marinas.
National security	L	A positive trend with transfer of military bases to the PR government.	Result in net increase in public access, most recently at the former Roosevelt Roads Navy Base in Ceiba.
Encroachment on public land	H	Encroachment problems continue to persist in Vieques and Culebra and in key south coast locations such as Parguera and Perimeter of the Jobos NERR	Illegal construction on public domain lands poses a major access and environmental threat. Addressing illegal construction in the MTZ is a costly, legally contentious, process

2. Emerging issues that are starting to affect public access or seem to have the potential to do so in the future

There are no new issues that threaten to adversely affect public access. However, with economic recovery, it can be anticipated that development pressures on waterfront land will intensify. Development pressures will be most pronounced along the northeast coast as well as in areas such as Culebra and Vieques where the conversion of military bases to civilian use has resulted in an upsurge in tourism, and retirement and second home construction.

3. (CM) Public perception of access availability to coastal recreational opportunities

Findings on public perception of coastal access availability have been deduced primarily from surveys conducted for the 2008-2013 SCORP.

The CMP lacks the resources for conducting systematic surveys of this type. However, based on information from multiple sources such as SCORP and DNER's environmental education and outreach program, the CMP has the capability of assessing local and regional demand for coastal recreational access.

A key finding, elaborated on below, is that coastal recreational access in unevenly distributed around the Island and that the lower socio-economic strata have the least opportunities for such access. The greatest potential for increasing coastal access is by concentrating on expanding opportunities in urban communities around the coast. The projected Sec. 306 program focus for coastal access will address these issues.

Table 2: Assessing public demand

Contextual measure	**Survey data**
Number of people that responded to a survey on recreational access to coastal locations	No user surveys specifically focusing on coastal access have been conducted by DNER/CMO. The 2008-2013 SCORP conducted a recreational demand survey based on telephone interviews with 551 households (approx. same number of persons).
Number of people surveyed that responded that public access to the coast for recreation is adequate or better	No specific survey on public access has been conducted.
Type of survey conducted (i.e. phone, mail, personal interview, etc.) by SCORP.	Telephone interviews with households; meetings with two focus groups (one with NGOs; one with local officials)
Geographic coverage of the SCORP survey.	Island-wide in ten regions of the island including Vieques and Culebra
Year the SCORP survey was conducted.	Household survey and focus groups in 2007-2008

3. Characterization of the demand for coastal public access within the coastal zone, and the process for periodically assessing public demand

While there is no current indication of wide spread public dissatisfaction with existing access opportunities, the most recent SCORP user demand survey highlighted a number of significant findings. Among major concerns expressed by respondents were:

- Lack of accessibility to regional recreation facilities
- Absence of public transportation
- Limited availability of parking
- Shortage of facilities for people with disabilities

Other survey findings:

- 51 percent of respondents engage in recreational activity in their local communities
- 49 percent of respondents engage in aquatic or beach related activities (thus providing a basis for extrapolating to coastal access demand)
- 50 percent believed that opportunities for outdoor recreation had improved between 2005 and 2008

The SCORP findings emphasized the need to provide recreational opportunities "at a community level", as well as the importance of providing recreational opportunities to all strata of the population. Given the severity of Puerto Rico's ongoing economic problems, constraints on government spending for capital projects are likely to preclude any near-term expansion of regional recreational projects along the coast.

4. Data on public access availability

The information provided on the table below is based on the best available data. The CMP is continuously adding to our data base through the Department's geo-coding and mapping program.

Table 3: Public access availability

Types of public access	**Current number(s)**	**Changes since last assessment (+/-)**	**Data source**
(CM) Number of acres in the coastal zone that are available for public access (total acres in the cz and acres avail. For public use)	Aprox.885,625 acres	Areas zoned as Public Coastal Accesses or Beaches by PRPB. Change is not statistically significant sin last assessment	PRCMP RS-GIS and updated CZM program document
(CM) Miles of shoreline available for public access (report both the total miles of shoreline	Puerto Rico's shoreline, including off shore islands is		CMO Cartographic data base (GIS) and

and miles available for public access)	799 miles of which 131 miles of beach are available for public access (public domain)		special DNER surveys.
Number of State/County/Local parks and acres	There are 15 Commonwealth managlic beaches covering 1500 acres. Larger cities such as Ponce and Carolina operate their own beach facilities. Some of The island's 44coastal municipios have developed small beach sites that cater to local needs.	No statisticallysignificant change	Regional surveys conducted by CMO and Public Access component of Sec. 309 Program. SCORP
Number of public beach/shoreline access sites	Fifteen full service public beach sites; two large municipal beach sites; approximately 300 small municipal access sites	No statistically significant change	Regional surveys conducted by CMO, Public Access component of Sec. 309 Program. DNER Regional Offices Beach Cleanup activities
Number of recreational boat (power or non-power access sites)	60 boat access sites	No statistically significant change	As above, SCORP
Number of designated scenic vistas or overlook points	87	None	SCORP and CMO data base
Number of State or locally designated perpendicular rights-of-way (i.e. street ends, easements)	Approx. 250	Data unavailable	Planning Board
Number of fishing access points (i.e. piers, jetties)	One (1) fishing pier designated in Humacao; numerous fishing villages have multi-use piers and jetties.	None	CMO data base
Number and miles of coastal trails/boardwalks	Three (3) miles in Piñones/ Loiza, Ponce, Aguirre Forrest/ Guayama	Two (2); Isabela, coastal pedestrian and bicycle trail, and the Mayaguez boardwalk and lineal park	CMO data base, SCORP
Number of dune walkovers	Three(3) dune walkovers all in		CMO data base

	Piñones		
Percent of access sites that are ADA compliant access	Two (2) at Luquillo and Boqueron	Approx. 10 percent of major beach facilities	CMO data base
Percent and total miles of public beaches with water quality monitoring and public closure notice programs	All Commonwealth and municipal beaches	No change	Environmental Quality Board, Beach Water Quality Monitoring program

5. Supplementary information pertaining to resource characterization

The following material supplements the information presented in the foregoing tables. Same text may replicate earlier assessments, but all quantitative information has been updated to reflect current conditions.

5.1 Public access to beaches and shorefront

a. Commonwealth beach and recreational facilities Parks in Puerto Rico that provide access to the coast are owned and/or managed by the National Parks Development Company (NPDC) , local governments or, in a few cases, by the Conservation Trust. The National Parks Development Company (NPDC) has recently been incorporated into the PRDNER. The NPDC's 15 public beach facilities cover 1500 acres along some 33 kilometers of the best beaches on the Island. No new regional recreational facilities have been developed in the period 2006-2010.

b. Municipal beach and recreational facilities While most large public beaches are managed by the Commonwealth there are a few exceptions:

- The city of Ponce has developed an integrated public beach, boardwalk and park facility at the La Guancha coastal port area and a recreational complex at Las Cucharas.
- The municipality of Carolina has managed the operation of the Isla Verde Beach during the past decade. In the period 2006-2010 the municipality invested approximately $2 million in a beach nourishment program for its 1,000 meter shoreline.
- Some of the island's coastal municipios have developed small beach facilities that cater exclusively to local needs and take advantage of unique physical attributes that require minimal investment. These are largely undocumented micro-projects that enhance coastal access in many of the small towns around the island.

c. Boat ramps DNER conducts an active program of boat ramp construction for recreational fishing and boat launching, funded in part by the US FWS.

- As of 2010, 60 public boat-launching ramps exist island-wide, a majority of which provide access to salt water. In the past 5-year period newly constructed facilities include the Humacao fishing pier, the Cataño, Toa Baja and CaboRojo boat ramps and trailer parking facilities.

- During 2007-2008, new public access boat ramps were built by DNER at El Combate, CaboRojo, Isla de Cabras, Toa Baja, and Cataño. Three additional USACE-funded projects are currently being permitted for La Parguera; CañoTiburones, and Aguadilla.
- DNER has designed three more public projects for coastal boating access: CañoTiburones (Arecibo), Aguadilla breakwater (Aguadilla), and Piñones (Loiza).

d. Scenic vistas Redevelopment of industrial waterfronts to include coastal promenades with vistas of the harbor and adjacent waterways has occurred in Old San Juan, Ponce and Mayaguez. Smaller urban centers possessing sheltered harbors and visual attributes can similarly benefit by creating seaside parks and promenades. Such development, particularly in high vulnerability locations, should be designed to mitigate potential damage from coastal hazards.

e. Rights-of-way The principal measure for providing public-rights-of-way to the shore continues to be Planning Board Regulation Number 17. There is no current count of the number of these rights-of-way around the island, nor is there any record of how they are maintained. There is an obvious need to improve management oversight over the r-o-w process in coastal subdivisions.

CMO, working through the Sec. 309 program has provided technical assistance and information to municipal officials, and encouraged local community-based organizations to take a proactive role in seeing that these public access-ways are identified and remain unrestricted for public access..

f. Access for the disabled New public beach facilities are designed to meet the requirements of the ADA. An estimated 5-10 percent of public beaches provide facilities for the disabled.

g. Boardwalks/walkways A wide variety of pedestrian access ways, including dune-walk-over's, exist in Puerto Rico.

Aguadilla, Arecibo, Arroyo, Guánica, Cataño, Mayaguez, Ponce, Naguabo, Santa Isabel, Aguada, Toa Baja, Luquillo, Fajardo and San Juan havepedestrianpromenadesalongtheirwaterfronts. DNER has constructed some elevated walkways and dune over-passes in beach and mangrove areas, most notably in the Piñones area, the Aguirre Coastal State forest and, the Jobos Bay NERR.

h. Refuges Two wildlife refuges have been formally designated; the Boqueron Refuge in the southwest, and the Caño Martin Peña in the San Juan area, part of the San Juan Bay Estuarine System.

i. Other recreational boating facilities As reported by the U. S. Coast Guard, in 2010 there were 60,652 registered boats in Puerto Rico, of which 59,295 were recreational vessels. While Puerto Rico does not have any public marinas, the rapid growth of recreational boating has resulted in the establishment of 40 private marinas, boat yards, and boating clubs that can accommodate about 10,000 vessels in the water and on racks.

Pursuant to the Marine Safety Law (Law 48 of 1986, as amended by Law 430 of 2005), DNER, through the Commissioner of Navigation, has installed 31 kilometers of buoys at 47 of the most popular beaches to separate boaters from encroaching on swimming areas.

Management Characterization

Effectiveness of management efforts to address the problems described in the above section.

1. Approaches employed in addressing problems

Significant changes that have occurred since the last assessment are indicated in the table below:

Table 4: Change in use of management categories since the last assessment

Management categories	**Employed by state/territory (Y or N)**	**Significant changes since last assessment (Y or N)**
Statutory, regulatory, or legal system changes that affect public access	Y	N
Acquisition programs or policies	Y	N
Comprehensive access management planning (including GIS data or database)	Y	N
Operation and maintenance programs	Y	N
Alternative funding sources or techniques	Y	N
Beach water quality monitoring and pollution source identification and remediation	Y	Y
Public access within waterfront redevelopment programs	Y	N
Public access education and outreach	Y	Y
Other (please specify): Maritime infrastructure	Y	N
Public Access Enhancement	Y	Y

Significant changes since the last assessment are elaborated upon below

a. Regulatory programs

No significant changes affecting public access have occurred.

b. Acquisition programs

No new public acquisitions of waterfront properties have occurred.

c. Operation and Maintenance programs

The beach O&M program, conducted by DNER's regional offices as slowly evolved since the last assessment and now represents a significant source of local support for the Sec. 309 public access program.

d. Inovative funding

No innovative funding techniques have been implemented. All funding for public access is provided through standard budgetary processes. Fee income from camping and similar charges reverts to the general fund. No innovative measures for increased funding for public access have been proposed.

e. Public Education and Outreach

Under the regular Sec. 306 program, DNER has consolidated its public education and community outreach resources under an Assistant Secretariat for Information and Education. The outreach staff of the Ranger Corps and the Marine Safety education staff of the Commissioner of Navigation continue to function independently. The consolidation promotes more efficient coordination and scheduling of educational and outreach activities and permits more effective use of personnel and audio-visual equipment available for that purpose.

f. Coastal Water Quality

Water quality sampling, testing and monitoring is under the jurisdiction of the Environmental Quality Board, with funding provided by the U.S. Environmental Protection Agency. Water quality test results are published quarterly and made available to the public through local media. To provide broad oversight on beach conditions the legislature established the State Beach Management Board (Junta de Playas). Membership includes EQB, DNER, Navigation Commission, Tourism Company, National Parks Company, Commonwealth Police Department, and the Ranger Corps.

Table 5: Priority Needs and Information Gaps

Needs and Information gaps	Priority
Govt commitment for proactive access program Puerto Rico's tourism industry is highly dependent on maximizing public access to the	

coast. However, there is no formal commitment on the part of the executive or legislative branches to implement a public access program other than though enforcement of the Maritime Zone Regulation (Reg. 4860) and PRPB Regulation 17. While the potential exists for carrying out a plan that combines federal, local, and private resources that would increase accessibility to the coast, such an initiative has not received official support, nor have funds for land acquisition been made available from the legislature on a regular basis.	High
Public funding Although the Natural Heritage Program has been assigned some resources by the Legislative Assembly with which to acquire critical environmental lands, such funding is not regularly replenished, and cannot be relied upon for implementing a long-term acquisition program that enhances public access to the coast.	High
Local government involvement in CZMP No overall program has been developed whereby municipal governments participate in coastal zone planning and management despite their having obtained increased planning authority under the Municipal Reform Act and, more recently, as a result of the Permit Process Reform Act (Dec.1. 2009). Nevertheless, as a result of the Sec. 309 coastal access program there have been examples of specific project agreements with municipios for public access facility development, as well as cooperation in implementing the coastal access signage program.	High
Impoved coastal access in urban areas and population centers Accessibility to coastal recreation is needed in urban areas where population densities are highest and where travel to regional beach recreation facilities may impose economic hardships	High
Inventory of deeded accessways in land subdivisions Even though there is a regulatory requirement for deeding public access in beach-fronting subdivisions, there is no data base identifying the location of public easements, nor is it clear who is responsible for maintenance.	Moderate
Vehicular parking Without providing space for vehicular parking, a deeded public r-o-w is of limited value. There is a need to include provisions for off-street parking in regulations governing beach-fronting subdivisions	Moderate

Enhancement Area Prioritization

1. Priority ranking

Prior assessment: HIGH

Current assessment: MED

2. Justification for priority ranking and for programming further work on public access to Sec. 306

Justification for assigning a high priority to public access is borne out by the most recent SCORP, the results of CMO staff findings, and by the public response to the survey conducted by DNER in formulating the 2011-2015 Sec.309 program.

The past work done under the public access component of the Sec. 309 program has laid the basis for a more integrated island-wide public access program to be conducted under the regular Sec. 306 program. Justification for this change has been provided in the earlier discussion of the change

in Program Focus. Accordingly, no further strategy for the public access component is included in this document.

OCEAN RESOURCES ASSESSMENT

Section 309 Enhancement Objective

Planning for the use of ocean resources within the Puerto Rico territorial waters and submerged lands beneath them.

Resource Characterization

Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.

1. Ocean resources and uses, and existing and future threats or use conflicts

Table 1: Ocean resources and uses; threats or use conflicts

Resource or use	**Threat or use**	**Degree of threat**	**Anticipated threat**
Mangroves	Direct and indirect impact from development of public and private infrastructure, land based sources of pollution, water quality degradation	M	Loss of resource area and reduction of system's capability to adapt to sea level rise
Estuaries	Shoreline modification, water quality degradation, land based sources of pollution	M	Urban and agricultural loadings
Seagrass	Coastal development, water quality degradation; boat scaring; shoreline change, oil spills	L-M	Coastal Development, boater Impacts, land based sources of pollution, reduced light penetration resulting in loss of areal extent; oil spills
Fisheries	Loss of habitat, overfishing	M	Loss of habitat due to land based sources of pollution; climate

			change impacts on coral reefs, overfishing
Sea Turtles	Coastal development, light pollution, shoreline hardening, loss of nesting areas due to beach erosion	M	Loss of nesting areas associated with coastal development; shoreline hardening and beach erosion
Marine Mammals	Boating, water quality, oil spill risks	L-M	Impacts on marine mammals by boating activities or oil spills

2. Resource changes or relative threat to the resources since the last assessment

Coral Reefs and associated benthic communities

Threats to coral reef ecosystems have increased due to land based sources of pollution, bleaching and mortality from diseases. During 2005, live coral cover was severely impacted by increased sea surface temperatures and disease. Coral reefs have been declining over past decades. NOAA's Coral Reef Conservation Program has been instrumental in providing greater understanding of the threats to coral reefs.

Seagrass resources

Puerto Rico has abundant seagrass resources. There has been an increase in seagrass coverage between Vieques and the main island of Puerto Rico. Past dredging at the Port of Las Americas (Ponce) and the navigation channel for EcoElectica power plant facilities has impacted benthic habitats -- seagrass beds and hard bottom habitats. Seagrass habitats are directly impacted by dredging activities and boat propeller scaring and indirectly by reduced light penetration caused by increased sedimentation or burial from dredging activities.

General

The U.S. Army Corps of Engineers, Fish and Wildlife Service, National Marine Fisheries Service and DNER are the key decision-making agencies affecting marine resources use and protection. Although existing policies and regulations provide protection to ocean resources, permitting actions have resulted in development-related impacts to coastal and marine resources. Going forward, climate variability and change may pose a growing threat to these resources.

Management Characterization

Purpose: To determine the effectiveness of management efforts to address the problems described above.

1. Approach employed for each of the management categories in the following table, and

indication of whether significant changes have occurred since the last assessment

Table 2: Use of management categories and changes since last assessment

Management categories	Employed by State/Territory (Y/N)	Significant changes since last assessment (Y/N)
Comprehensive ocean management plan or system of Marine Protected Areas	Y	N
Regional comprehensive ocean management program	N	N
Regional sediment or dredge material management plan	N	N
Intra-governmental coordination mechanisms for ocean management	Y	Y
Single-purpose statutes related to ocean Resources	Y	Y
Comprehensive ocean management statute	N	N
Ocean resource mapping or information system	Y	Y
Ocean habitat research, assessment, or monitoring programs	Y	Y
Public education and outreach efforts	Y	Y

2. Information on management categories since the last assessment relative to:

- *Significant changes since the last assessment;*
- *Whether it was a 309 or other CZM-driven change (specify funding source) or if it was driven by non-CZM efforts;*
- *Characterization of outcomes and effectiveness of changes.*

Single-Purpose Statutes Related to Ocean Resources

- The Fisheries regulation was amended in 2010. Amendments include revised penalties and clarification of permanent or seasonal closures for the harvesting of marine species. No CZMP changes have resulted. While it is too soon to evaluate outcomes and effectiveness, the revisions are significant and are likely to strengthen the role of DNER in marine and ocean resources management.

Ocean Resource Mapping and Government Information System

- PRCMP developed and maintains its Remote Sensing and GIS unit. This system is integrated with DNER's GIS and the newly developed Government-wide Information System. This Island-wide system provides spatial data and metadata to support resource management. There has been an increased use of GIS for mapping coastal and estuarine habitat, and the unit provides support for Sec. 309-related activities, particularly with respect to wetlands. The program has been consistently evolving during the 2005-10 program period and has been driven by, though not directly funded by, NOAA/OCRM initiatives.

Ocean Habitat Research, Assessment, or Monitoring Programs

- Coral reef, coastal habitats and geomorphic features and estuarine monitoring efforts at DNER, EQB, JBNERR, and the San Juan Bay Estuary Program have expanded. NOAA's Biogeography program and CaRA-CARICOOS routinely meet with PRCMP Director and staff as well as UPR scientists to identify data collection, information processing and management needs.

Public Education and Outreach Efforts

- There has been an increase in CAMA public education programs.

Caribbean Region Ocean Partnership

- Throughout the islands of the Caribbean all communities may be regarded as being coastal dependent. Puerto Rico's coastal communities are highly dependent upon the ocean and its resources to support dynamic ecosystems, working waterfronts, maritime commerce, tourism, recreation, energy, and healthy, disaster-resilient communities.

- A plan for developing a comprehensive regional ocean partnership (ROP) for the U.S. Caribbean territories is needed to more effectively manage coastal and marine ecosystems as they respond to natural processes and anthropogenic activities, as well as to reduce existing and anticipated conflicts among stakeholders. Effective communication, coordination, and cooperation among regional stakeholders is essential if sustainable management plans are to be developed for the Caribbean region as a whole and for specific sub regions.

- PRCMP-CMO in coordination with the Office of the Governor of the USVI and TNC developed the proposal for the establishment of the U.S. Regional Ocean Partnership. PRCMP Director and TNC consultant prepared a draft Memorandum of Understanding between the Governor of Puerto Rico and the Governor of the USVI.

- The Governors of Puerto Rico and the U.S. Virgin Islands have indicated, by way of written intent, their commitment to advancing coastal and marine spatial planning (CMSP) in alignment with the Ocean Policy Task Force. Regional organizations such as the Caribbean Fisheries Management Council, Sea Grant, CaRA-CARICOOS, and the Caribbean Coral Reef Institute support this PRCMP initiative. In furtherance of this effort, PRCMP and the U.S. Virgin Islands together with The Nature Conservancy have partnered to seek funding to initiate the development of the ROP initiative.

- PRCMP funded marine spatial planning efforts through 309 coastal habitat and wetlands task activities addressing characterization and zoning needs for marine wetlands, territorial waters and submerged lands.

- PRCMP has retained a consultant to conduct the analysis of the Legal and Institutional Framework for the development of the Regional Ocean Partnership and initiate U.S. Caribbean Region coastal and marine spatial planning.

- PRCMP Director and Wetlands Task leader are part of the coastal and marine spatial planning working group that will be convened June 2011 by the National Ocean Council.

Priority Needs and Information Gaps

The following table identifies major gaps or needs (regulatory, policy, data, training, capacity building, communication and outreach) for addressing each of the enhancement area objectives. These needs could be addressed through the CMP and partners (though not limited to activities to be undertaken through the Section 309 Strategy).

Table 3: Major gaps or needs

Gap or Need description	Function or Area	Priority
Staff training to assess coral damage	Training	H
Inventory of viable offshore renewable energy sites	Policy	H
Coral reefs and associated communities mapping and	Data and information	

monitoring	processing	H
Long-term monitoring of coastal habitats and biodiversity	Capacity building: data collection and analysis	H
Policy and regulations	Regulatory and enforcement	M-H
Institutional arrangements for regional cooperation	Legal and institutional	M-H

Enhancement Area Prioritization

1. Priority ranking (including but not limited to CZMA funding)

High

Medium X

Low

2. Justification for priority ranking

Coastal managers and stakeholders that were consulted ranked ocean resources as a medium-high priority. Most stakeholders indicated that this enhancement category needs priority attention. Yet, most agreed that there were higher priority needs in Puerto Rico. Nevertheless, the PRCMP recognizes the importance of addressing Ocean Resources. Accordingly, separate funding has been requested to develop the Caribbean Regional Ocean Partnership. This effort will enable Puerto Rico to comprehensively address issues such as energy facility siting, aquaculture, marine debris, and certain aspects of climate change. This work is proposed to be developed following the guidelines issued by the White House through the Executive Order of President Obama (July 2010).

3. The CMP will not develop a strategy for this enhancement area

The PRCMP will not develop a comprehensive strategy for this enhancement area although it is recognized as an ideal planning framework to address multiple threats to ocean resources in Puerto Rico.

However, the governments of Puerto Rico and the U.S. Virgin Islands have agreed to pursue the development of the U.S. Caribbean Regional Ocean Partnership. Although funding constraints may limit the pace of the regional effort, both jurisdictions recognize the need for a coordinated approach to the mapping, monitoring, and management of marine corridors.

PRCMP actively participates in several federal and Commonwealth initiatives to map, monitor, and manage coral reefs and associated communities. Improving knowledge about ocean resources through mapping and monitoring activities is critical to developing baseline data and information to support ecosystem management. This is particularly important in view of the potential impacts on Puerto Rico's ocean and coastal resources resulting from climate change and sea level rise.

MARINE DEBRIS ASSESSMENT

Section 309 Enhancement Objective

Marine debris reduction through management activities taking into account current and future distribution trends.

Resource Characterization

Eighty percent of marine debris is land-based generated. The management and disposal of solid waste in Puerto Rico is intensified by the limited disposal area available on an island community with a delicately balanced ecosystem. Puerto Rico's per capita volume of solid waste generation is higher than on the mainland, while recycling rates are lower. Much of Puerto Rico's solid waste ends up in one of island's 32 landfills, most of which do not comply with Commonwealth and federal landfill requirements. The solution calls for a comprehensive and integrated solid waste management plan to reduce solid waste generation, increase recycling, use waste to produce energy, and efficiently manage all landfills.

Key Commonwealth agencies with responsibilities in this area are the Solid Waste Authority, the Environmental Quality Board, and DNER's Regional Offices which, through their Beach Maintenance Brigades, conduct weekly beach cleanups. Voluntary organizations are also active. Voluntary groups in Puerto Rico annually record marine debris data as part of international coastal cleanup activities. During the 2010 Beach Cleanup Day, 12,659 volunteers worked together to collect more than 198,858 pounds of solid waste from our beaches, lakes, and waterways.

Table 1: Sources and Impacts of marine debris in the coastal zone

Source of marine debris	**Extent of Source (H,M,L)**	**Type of Impact (aesthetic, resource damage, user conflicts, other)**	**Significant Changes since the last assessment (y or n)**
Land based- Beach/shore litter	H	Aesthetic, resource damage, user conflicts	Y
Land based- dumping	H	Aesthetic, resource damage, user conflicts	N
Land based-storm drains and runoff	H	Resource damage, non-point contamination	N
Land based- Fishing	L	Aesthetic, resource	Y

related (e.g. Fishing line, gear)		damage, user conflict	
Ocean based- derelict fishing gear	L	Resource damage, user conflict	Y
Ocean based derelict vessels	M	Resource damage	Y
Ocean based- Vessel based(cruise ship,cargoship,general vessel)	H	Aesthetic, resource damage, non-point contamination	Y
Hurricane /storm	H	Resource damage	Y
Other	N/A	N/A	N/A

Supplementary information Pertaining to Resource characterization

Voluntary groups and programs involved in marine debris management

Vida Marina, Caribbean Center for the Reduction of Aquatic Debris, University of Puerto Rico. Collection of microscopic particles of anthropogenic origin (fragments of plastic, paint, rustships, pieces of synthetic thread, etc.). Currently working on the analysis of a series of samples that were taken on the Puerto Rico Coast on February 2009 from the OSV/Bold.

Monofilament Recovery and Recycling Program of Puerto Rico, University of Puerto Rico. Implementation of the first monofilament recovery and recycling program in Puerto Rico. The Agricultural extension program will construct and install 45 monofilament recovery stations throughout Puerto Rico at various high volume fishing locations with the help of volunteers. All the lines collected will be shipped to a monofilament recycling compound.

ACC's Plastic Division (formerly APC), in conjunction with the **Center for Marine Conservation,** is researching ways to identify effective methods to reduce litter through reduction and improved waste handling. With support from the plastic industries, the National Model Communities Program launched a marine debris remediation program targeting six communities, one of which is Pinones. Visitors frequent small roadside stands and open air restaurants in the Pinones area leaving large amounts of trash that is a threat to endangered species and to the largest mangrove forest remaining in Puerto Rico.

Marine Reserve Tres Palmas has established a marine waste handling disposal project. The objective aims to restore existing coral reefs habitats by eliminating waste through an educational awareness program for schools and voluntary work.

Amigos de Amoná, Inc., a non-profit based organization, **i**mplemented the Mona Channel Marine Debris Removal (2004). One of their goals was to remove the marine debris that affected marine life and coastal habitats. Thirty volunteers donated 1,363 hours of labor to survey 26.5 Km of coastline. They removed 3,235 Kg.(7117.0 lbs) of marine debris classified as fishing gear (48%), plastics (13%), glass(14%), metal (8%), and others (17%) . Additionally a conservation guide was developed for visitor and boaters.

Scuba Dogs, Inc. This is a non-profit organization that coordinates the International Coastal Cleanup Days in Puerto Rico.

Management Characterization

Purpose: To determine the effectiveness of management efforts to address the problems described above.

1. Approach employed for each of the management categories in the following table, and indication of whether significant changes have occurred since the last assessment

Table 2: Use of management categories and changes since last assessment

Management categories	**Employed by state/territory** (Y or N)	**Employed by local governments** (Y, N, Uncertain)	**Significant changes since last assessment** (Y orN)
Recycling requirements	**N**	**Y**	**N**
Littering reduction programs	**Y**	**Y**	**N**
Wasteful packaging reduction programs	**N**	**N**	**N**
Fishing gear management programs	**Y**	**N**	**N**
Marine debris	**Y**	**N**	**N**

concerns in harbor, port, marine, & waste management plans			
Post-storm related debris programs or policies	**Y**	**Y**	**Y**
Derelict vessel removal programs or policies	**Y**	**N**	**N**
Research and monitoring	**Y**	**Y**	**N**
Marine debris education & outreach	**Y**	**Y**	**Y**
Other (Derelict trap retrieval programs)	**Y**	**Y**	**Y**

1. Governmental role

Two Commonwealth agencies: Solid Waste Authority and the Environmental Quality Board have the local responsibility for managing the Island's solid waste.

Marine debris management activities:

- Derelict vessel removal and cleanup is coordinated by NOAA, USACE and DNER.
- PRCMP supports DNER Regional Offices and Beach Maintenance Brigades that conduct weekly cleanups at Puerto Rico's 434 miles of coastline.
- National Parks Company maintains and conducts routine cleanups of 12 public beaches under their administration.
- Municipalities such as Carolina conduct routine maintenance of public beaches under their administration.

Priority Needs and information Gaps

Table 3: Priority needs and information gaps

Gap or need description	Type of need (regulatory, policy, data, communication and outreach)	Level of priority (H,M,L)
Wasteful packaging reduction programs	Raise awareness of biodegradable disposable products	H
Educational awareness	Voluntary monitoring activities and training.	H

Enhancement area prioritization

1. Priority ranking (including, but not limited to, CZMA funding)

High

Medium X

Low

2. Justification for priority ranking

Agency partners and stakeholders place a medium priority for the marine debris enhancement category for the island. Solid waste management is an important and very complex issue for the Commonwealth of Puerto Rico. Marine debris must be integrated in the Comprehensive Solid Waste Management Plan developed by the Solid Waste Authority. PRCMP will continue supporting ongoing efforts and will coordinate with the Solid Waste Authority in addressing the marine debris problem as part of the comprehensive plan. However, at this point PRCMP will not develop an enhancement area strategy for marine debris.

To effectively reduce the volume of marine debris active participation is needed from the Puerto Rico Solid Waste Authority, Puerto Rico Environmental Quality Board, Puerto Rico Tourism Company, Puerto Rico Ports Authority, PRCMP, SeaGrant, NGOs, coastal municipalities and multiple stakeholders. This initiative may be pursued as part of the Puerto Rico component of the Caribbean Regional Ocean Partnership and the Coastal and Marine Spatial Planning processes.

3.Strategy for this enhancement area

The PRCMP will not develop a comprehensive strategy for this enhancement area.

AQUACULTURE ASSESSMENT

Section 309 Enhancement Objective

Development of procedures and policies to evaluate potential siting of aquaculture facilities in the coastal zone to enable the Commonwealth of Puerto Rico to formulate, administer, and implement strategic plans for marine aquaculture.

Resource Characterization

Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.

1. Present state of aquaculture development in Puerto Rico

Table 1: Private and public aquaculture facilities currently operating

Type of existing aquaculture facility	**Describe recent trends**	**Describe associated impacts or use conflicts**
Companies with permits to culture fish in PR territorial waters (1)	Aquaculture production decreased from 205.0 metric tons in 2001 to 166.0 in 2005	Conflicts sometimes occur when commercial fishermen and aquaculture ventures compete for the same space. Most of the mariculture systems require deeper waters (depths greater than 100ft) Concern: pathogens associated with cultured fish and potential impacts on adjacent marine communities.
" Marine fish culture" (2)	Decreasing due to permit problems and local fish producers when product is sold in local markets.	Conflicts between the commercial fishermen and the marine aquaculture industry occur when aquaculture products drive prices down and impact commercially harvested seafood products.
Freshwater fish on land (3)	Aquaculture production increased from 209 metric tons in 2001 to 251.o in	Discharge of low quality water and solid waste

	2005.	
Freshwater fish hatcheries (4)	Not available	Discharge of low quality water and solid waste
Small-scale coastal aquaculture operations	Not available	Discharge of low quality effluent runoff, and the introduction of exotic organisms to fresh and marine waters.

2. Private and public aquaculture facilities (in operation as of 2001-05)

- Snapper farm, Inc. engages in open ocean aquaculture operation in the United States. It raises and harvests cobia and other species of marine fish in submerged open ocean cages. The company was founded in 1998 and was based in Culebra, Puerto Rico. In May 2002, the first offshore aquaculture enterprise in Puerto Rico was launched by Snapper farm, Inc. and by August they began stocking two Ocean Spar Sea Station cages, one with 12,000 cobia and the other with 4,000 mutton snapper juvenile fish, in the waters off the island of Culebra. The firm ceased operations in Puerto Rico and moved to Panama. Firm representatives are trying to resume operations in Puerto Rico.
- Ocean Harvest Inc., Humacao, is an aquaculture company focusing on development of warm water fish species for food.
- Borinquen Aquaculture Inc., Rincon.
- C-Quest in Salinas is the oldest continuously operating marine hatchery and farm facility in the world. Located on the south shore of Puerto Rico, C-Quest is located on 52 acres of beach front property with ample crystal clear water from the Caribbean Sea.
- Caribe Fisheries in Lajas produces quality ornamental fish and aquaculture products. In addition they provide international consulting services to the aquaculture industry.
- DNER managed hatchery in Maricao.

The following table summarizes general trends in the aquaculture industry from 2001-05.

Table 2: Aquaculture Production (*) in Puerto Rico by Environment 2001-2005

Environment	**2001**	**2002**	**2003**	**2004**	**2005**
Freshwater	209.0	217.0	200.0	251.0	251.0
Marine & Brackish	205.0	225.0	69.0	166.0	166.0

Aquaculture byproducts (*)

Products	2001	2002	2003	2004	2005
Crustaceans	212.0	233.0	173.0	206.0	206.0
Freshwater fish	202.0	209.0	96.0	211.0	211.0

(*)Metric tons

Source: FAO Fisheries and Aquaculture Information and Statistics Service. 2007.

Available at: http://www.fao.org/fi/statist/FISOFT/FISHPLUS.asp

List of Ornamentals distributed in Puerto Rico

Olive Dottyback	Pseudochromis	olivaceus
Redheaded Goby	Elacatinus	puncticulatus
Katy's Goby	Gobiodon	sp.
False Skunk Clownfish	Amphiprion	akallopisos
Sailfin Molly	Poelcilia	Velifera
Sunrise Dottyback	Pseudochromis	flavivertex
Percula	Amphiprion	Percula
Orange Skunk	Amphiprion	sandaracinos
Blackline Fangblenny	Meiacanthus	nigrolineatus
Mozambique Fangblenny	Meiacanthus	mossambicus
Cinctus Goby	Cryptocentrus	Cinctus

Mnagement Characterization

1. Effectiveness of management efforts to address problems described in above section

Table 2: Use of management categories and changes since last assessment

Management Categories	**Employed (Y or N)**	**Significant Changes since last assessment (Y or N)**
Aquaculture regulations	Y	Y
" Policies	Y	Y
" Program guidance	Y	N
Research, assessment, monitoring	N	N
Mapping	N	Y
Aquaculture education & outreach	Y	Y
Other (please specify)	N/A	N/A

2. Significant changes since the last assessment

a. Aquaculture Regulations

The Puerto Rico Planning Board Joint Regulations specify zoning districts and conditions governing aquaculture development. Marine zoning is consistent with the new National Ocean Council policy that encourages development of aquaculture projects.

b. Aquaculture Policies

On March 31, 1999 the Puerto Rico Senate adopted Project 581, requesting the Land Authority to designate 75 acres for the development of aquaculture projects. However, there has been no change in the aquaculture industry as a result of this action.

c. Mapping

As part of the marine spatial analysis conducted under the Wetlands task, aquaculture experts provided PRCMP-CMO locations of priority areas where culture of fish in open ocean cages could be promoted. These areas were identified in 100-200 ft depth

segments of the Puerto Rico territorial waters. No formal zoning or designations have resulted from this analysis.

Locations and areas for potential aquaculture projects in Puerto Rico:

- West coast: 5 areas
- East coast : 2 areas
- South coast : 5 areas
- North coast : 5 areas

3. Aquaculture education and outreach

During November 2010, The NOAA Aquaculture Program and Coral Reef Conservation Program hosted the first in a series of invitational workshops aimed at developing environmental guidelines and standards for aquaculture operations sited near coral reef ecosystems. This workshop focused on several key goals, including: exchanging available information (e.g., research, monitoring results, model output), identifying knowledge gaps, reviewing permitting procedures, and identification of key elements for development of regional best management practices. Private firms, university researchers, and government agencies (PRCMP, USACE, NMFS and EPA) presented their views and concerns on issues such as: coral reef ecology, aquaculture research and monitoring, best management practices, and environmental standards.

Sea grant and the Universities of Humacao and Mayaguez, conduct research and educational activities for aquaculture development.

Priority Needs and information Gaps

Invasive Lionfish control and management is a priority need to DNER and to coastal and marine resources managers , marine ecologists and fishermen in the wider Caribbean region. NGO's, and fisheries officials throughout the Caribbean and Gulf of Mexico have discussed strategic approaches to address ecological impacts and regional control strategies for lionfish management.

The table below identifies major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing the enhancement area objective.

Table 4: Priority needs and information gaps

Gap or need description	**Type of need (regulatory, policy, data, communication and outreach)**	**Level of priority (H,M,L)**
Benthic habitat characteristics and conditions	Areas of the PR shelf lacking benthic habitat maps should be prioritized for mapping.	H

Aquaculture development.	Monitor emerging issues surrounding aquaculture programs.	M
Monitoring of ornamental fish imports and exports	Regulatory, monitoring and enforcement	M
Exotic-invasive species in Puerto Rico	Data, monitoring, capacity bulding, enforcement	M

Enhancement area prioritization

1. Priority ranking (including, but not limited to, CZMA funding)

High

Medium X

Low

2. Justification for priority ranking

Small-scale coastal aquaculture may pose a significant environmental risk from the discharge of low quality effluent and runoff, and the introduction of exotic organisms and pathogens to fresh and marine waters.

3. Strategy for this enhancement area

The PRCMP will not develop a comprehensive strategy for this enhancement area. PRCMP envisions that an aquaculture strategy may be devised in coordination with NOAA's Aquaculture Program. Private firms that have shown interest in developing marine cage culture would be encouraged to participate as would local communities and relevant stakeholders under the proposed Coastal and Marine Planning process for Puerto Rico.

Energy & Government Facility Siting Assessment

Section 309 Enhancement Objectives

Adoption of procedures and enforceable policies to help facilitate the siting of energy and Government facilities, and energy-related and Government activities that may be of greater than local significance

Resource Characterization

Purpose: To determine the extent to which problems and opportunities exist with regard to the enhancement objective.

1. Types of energy facilities in the Puerto Rico coastal zone (e.g., oil and gas, Liquefied Natural Gas, wind, wave, Ocean Thermal Energy Conversion, etc.) based on best available data.

Table 1: Types of energy facilities in the Coastal Zone

Type of Energy Facility	**Exists in CZ** (# or Y/N)	**Proposed in CZ** (# or Y/N)	**Interest in CZ** (# or Y/N)	**Significant changes since last assessment** (Y or N)
Oil and gas facilities	Y	Y	Y	N
Pipelines	Y	Y	Y	N
Electric transmission cables	Y	Y	Y	N

LNG	Y	Y	Y	Y
Wind	N	Y	Y	N
Wave	N	N	Y	N
Tidal	N	N	Y	N
Current (ocean, lake, river)	N	N	Y	N
OTEC	N	N	Y	N
Solar	N	N	Y	N

2. Significant changes in the types or number of energy facilities sited, or proposed to be sited, in the coastal zone since the previous assessment

No significant changes have occurred in the type or number of oil and gas facilities. During the past five years the San Juan power plant has been reactivated and an explosion occurred at the Caribbean Petroleum (CAPECO) storage facility at Cataño. There are six major power plants located in Puerto Rico's coastal zone. Three of the power plants are located on the north coast: San Juan, Palo Seco, Cambalache and three on the south coast: Ecoelectrica and Costa Sur (Guayanilla), AES (Guayama) and Aguirre (Salinas).

The explosion, fire, and subsequent oil spill at CAPECO's petroleum tank farm created a dangerous situation that impacted the adjacent wetlands and water bodies. This facility is in the middle of a densely populated community. The environmental impacts continue to pose a threat to human health and the environment. cleanup activities are ongoing.

PREPA has proposed to build a LNG pipeline from EcoElectrica's terminal and storage facilities at Guayanilla (south coast of Puerto Rico) to Palo Seco and San Juan power plants on the north coast. Environmental assessments and permitting activities are underway, with completion date indeterminate given project complexities and the number of affected stakeholders.

3. Estimates of existing, and projections of future Commonwealth capacity to meet demand for natural gas and electric power generation

Puerto Rico Electric Power Authority (PREPA) generating capacity is 5,264MW, of which, 507 MW are produced at the natural gas fired EcoElectrica; 454 MW are produced at the coal fired Applied Energy System co-generator. There are long -term purchase agreements with co-generators. PREPA's generating capacity provides a 50%-75% reserve margin over peak electricity demand to ensure reliability. As a result the authority had an approximately 48% reserve margin over 2007 peak demand in September despite a fire in December 2006 that took the four Palo Seco units out of service.

The units provide 728 megawatts (MW), or 15% of installed capacity of 4,878 MW. Power purchased from two cogeneration plants increases total dependable capacity (including Palo Seco) to 5,839 MW. The $1.7 billion investment in the next five years will replace about 265 MW of generating capacity with more efficient units, and convert other units from higher cost fuel oil to natural gas. PREPA's move away from dependence on fuel oil began with the purchased power contracts for the cogeneration units on the south shore of Puerto Rico.

Natural gas stored in an Eco Electrica's terminal fuels one of the two cogeneration units, which began operating in 2000. The other cogeneration unit, which began operating in 2002, was designed to burn coal very efficiently. Equivalent availability at these two units has improved to 94%-96% from startup levels of near 80%. Equivalent availability for the entire system improved to 85% in 2007

(before the Palo Seco fire), up from 72% in 1995, as a result of investments in plant operation and communication. The absence of significant seasonal variations in demand results in a relatively high load factor of 77%-80%, which affords PREPA less flexibility to schedule maintenance. Therefore, the authority must have greater total reserve capacity than other U. S. mainland utilities to cover generating outages.

Despite the necessary excess capacity, the base rate is just 5.79 per kh. If PREPA can reduce fuel costs, rates will be much more in line with those in the mainland U.S. The dependence on oil-fired generating plants increased the average residential monthly electric bill to $80.48 in fiscal 2006-2007, $95.00 in 2007-2008, and $86.45 in 2008-2009, compared with $68.00 in 2004-2005 and $58.00 in 2003-2004. In fiscal 2009, purchased power accounted for 4.06 cents and fuel costs accounted for the remaining 11.68 cents of the total 21.53 cents per kh residential rates. PREPA envisions an 80% reduction on oil burning for electric power generation and a reduction of 60% on GHG emissions associated to the proposed conversion of power plants to burn natural gas and wind power generation.

4. Availability of specific Commonwealth programs for alternative energy development, including numerical objectives for the development of alternative energy sources, and any offshore or coastal components of these programs

Four major wind power facilities have been proposed for development at Guayanilla, Santa Isabel, Arecibo, and Naguabo. These are expected to be shore-based but no definitive site decisions have been made nor are permit applications under active review. Government is also considering the construction of waste-to-energy facilities to be built on the north coast of Puerto Rico as a means to address the solid waste issue and to generate electric power.

5.Changes in the types or number of government facilities sited in the coastal zone since the previous assessment

No major changes in the types or number of government facilities sited in the coastal zone have occurred since the previous assessment. Construction of the Ports of the Americas at Ponce has greatly slowed down. Energy facilities identified in previous sections are proposed under Public-Private Partnerships or by private firms.

Management Characterization

Effectiveness of management efforts to address those problems described in the above section.

1. Enforceable policies specifically related to energy facilities

The Puerto Rico Island-wide Land Use Plan adopted the PRCMP (1978) as its coastal land use plan establish general policies that apply to energy- related facilities:

> *"To avoid the unnecessary loss of options for future use of these resources resulting from the establishment of new activities from authorizing subdivisions"(Policy 17.04)*

In the case of power plants, this policy would call for avoiding the loss of options that would result from residential development.

PRPB Island-wide Land Use Plan Policy 4.00 indicates that industries should be concentrated in those areas most appropriate for industrial uses, and at the same time, to promote the most intensive use possible of such lands.

PRPB Policy 4.03 specifies the need to identify and reserve sites for industrial facilities (including Energy facilities). However, PRPB Policy 8.01 excludes lands of high agricultural productivity, floodable areas (PRPB 11.00), and important natural or critical environmental resource areas (PRPB 16.00).

2. Significant management changes since the last assessment

Table 2: Use of management categories and changes since last assessment

Management Categories	**Employed by state/territory (Y or N)**	**Significant changes since last assessment (Y or N)**
Statutes or regulations	Y	Y -- (see item 3 below for statutory, regulatory, and institutional changes)
Policies	Y	N -- PRPB policies apply
Program guidance	PRPB policies	N -- PRPB policies apply
Comprehensive siting plan (including SAMPs)	N	N
Mapping or GIS	Y	Y (pr.gov GIS)
Research, assessment or monitoring	UPR	Y – Increased level of activity and allocation of resources
Education and outreach	Y	Y -- In relation to 3 below

3. Outcomes

PRPB land use policies guide energy and government facility siting as well as other land use and development activities. The PRPB led the effort that resulted in the adoption of the 2009 Permits Law, the establishment of the Integrated Permit System and the Joint Permit Regulations for guiding future permitting and coastal development. Two new agencies were created by Law 161 to replace the former ARPe (Regulations and Permits Administration): OGPe (Permits Management Agency) and OIGPe (Permits Comptroller Agency).

The Department of Natural and Environmental Resources Department in coordination with the Energy Affairs Administration and the Solid Waste Authority have coordinated efforts to increase environmental compliance, natural resources conservation, recycling, reuse of solid wastes and energy efficiency at government facilities, and will continue serving in an advisory role to agencies with regulatory power.

Priority Needs and Information Gaps

1. Major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing the enhancement area objectives.

Table 3: Priority needs and information gaps

Gap or Need Description	**Type of gap or need** (regulatory, policy, data, training, capacity, communication & outreach)	**Level of priority** (H,M,L)
Resource information in territorial waters and submerged lands	Data	H
Assess potential impacts to coastal habitats and wildlife from renewable energy development	Data, policy, capacity, regulatory communications	H
Planning for siting of alternate sources of energy (wind, solar, OTEC) to minimize impacts to coastal habitats, wildlife and coral reefs	Data, capacity, policy, planning, regulatory	H

Enhancement area prioritization

1. Priority ranking (including, but not limited to, CZMA funding)

High

Medium X

Low

2. Justification for priority ranking

PRCMP has consulted partner agencies, experts and stakeholders regarding the priority level of the Energy and Government Facility siting enhancement area. Most stakeholders indicated that this enhancement category also needs priority attention. Yet, most agreed that there were higher priority needs in Puerto Rico. The PRCMP has identified that energy facility siting and ocean resources can be addressed through the proposed Puerto Rico component of the Caribbean Regional Ocean Partnership between Puerto Rico and the U.S. Virgin Islands. This work is proposed to be developed following the guidelines issued by the White House through the Executive Order of President Obama (July 2010).

3. Strategy for this enhancement area

The CMP will not develop strategies for this enhancement area. Nevertheless, the work to be conducted under the Wetlands Strategy for wetlands and submerged lands will address issues of "best use and best practices" to be implemented through the adoption of zoning maps and the promulgation of development guidelines to be developed as part of the Coastal and Marine Spatial Planning efforts to be implemented by the Governments of Puerto Rico and the U.S. Virgin Islands. (See above for further justification.)

CUMULATIVE AND SECONDARY IMPACTS ASSESSMENT

Section 309 Enhancement Objective

Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources.

Resource Characterization

1. Areas in the coastal zone where rapid growth or changes in land use require improved management of cumulative and secondary impacts (CSI) since the last assessment

PRCMP and federal and Commonwealth agency partners recognize the importance and connectivity of watersheds, coastal and marine systems. All of Puerto Rico, including Culebra and Vieques are considered interconnected coastal systems.

2. Sensitive resources in the coastal zone (e.g., wetlands, water bodies, fish and wildlife habitats, critical habitat for threatened and endangered species) that require a greater degree of protection from the cumulative or secondary impacts of growth and development

The lionfish poses a major threat to coral reef ecosystems in the Caribbean region by decreasing survival of a wide range of native reef animals via both predation and competition. Lionfish can consume prey up to 2/3 of its own length. Results of the experiment show that lionfish significantly reduce the net recruitment of coral reef fishes by an estimated 80%. The huge reduction in recruitment is due to predation and may eventually result in substantial, negative ecosystem-wide consequences. It is also important to note that lionfish have the potential to act synergistically with other existing stressors, such as climate change, overfishing, and pollution, making this invasion of particular concern for the future of Caribbean and Puerto Rico's coral reefs.

Table 1: Level of CSI threats to sensitive resources

Sensitive resources	**CSI threats description**	**Level of threat (H,M,L)**
Wetlands (Island-wide)	Wetland loss from changes in hysdrology and draining associated to agricultural practices	H
Coastal habitats and estuaries	Habitat loss and changes resulting from altering hydrology by diversion of rivers and construction of dams. Invasive species: Lionfish	M-H H
Aquifers and ground water supply	Pollution and lowering of potentiometric levels	M
Beaches (Island-wide)	Erosion	M
Seagrass	Water quality degradation, dredging and scarring from negligent boat operation	M-H

Management Characterization

Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.

1. The approach employed in addressing significant changes that have occurred since the last assessment

Table 2: Use of management categories and changes since last assessment

Management Categories	**Employed by state/territory**	**Significant changes since last assessment** (Y or N)

	(Y or N)	
Regulations	Y	N
Policy	Y	N
Guidance	Y	N
Management Plans	Y	Y
Research, assessment, monitoring	Y	Y
Mapping	Y	Y
Education and Outreach	Y	Y

Prior to the 2004 amendment of the Puerto Rico Environmental Policy Act, cumulative and secondary impacts analysis were not required in preparation of environmental impact analysis and environmental assessments. During the Section 309 cycle 2001-2005, PRCMP funded the development of a method for assessing cumulative and secondary impacts. The model was used to produce assessments for seven Special Planning Areas. The Puerto Rico Environmental Quality Board examined several methods for determining cumulative and secondary impacts, including the method developed by PRCMP, and integrated the requirement of analyzing cumulative impacts through the amended Environmental Policy Act.

While CSI analysis is of acknowledged importance, it is not an area in which the CMP has developed operational expertise. It could, however, play a supporting role, for example, in reviewing permit applications for energy facilities that impinge on coastal resource locations and sensitive ecosystems, particularly wetlands and submerged lands. The PRCMP, partner agencies and stakeholders participating at public hearings for the new Permits System and Law 161 Joint Permit Regulations have pointed out the need to ensure that trained personnel at the new Permits Management Agency (that began operations in December 2010) conduct environmental analyses to which CMO staff could contribute.

Priority Needs and Information Gaps

1. Major gaps or needs (regulatory, policy, data, training, capacity, communication and outreach) in addressing the enhancement area objectives

Table 3: Table 3: Priority needs and information gaps

Gap or need description	**Type of gap or need (regulatory, policy, data,**	**Level of priority (H,M,L)**

	training, capacity, **communication & outreach)**	
Training on direct, cumulative and secondary impact analysis	New Permit Management Agency staff	H
Alternate methods for treating wastewaters on areas not connected to PRASA systems	Management options and techniques, policy and regulatory needs	H
Ground water, aquifer, recharge areas and wetlands interactions	Monitoring, modeling	H
Comprehensive land use Planning	Regulatory and policy	H
Long-term assessment of status, health and trends of habitats and water quality	Data and capacity	H
Identifying critical areas within watersheds vulnerable to pollution .	Requiring that maps and models of critical areas are considered at the new Permits Management Agency	H

Enhancement area prioritization

1. Priority ranking (including, but not limited to, CZMA funding)

High

Medium X

Low

2. Justification for priority ranking

This is acknowledged to be an important subject area, but one in which CMO lacks the resources to play a leading role.

3. Strategy for this enhancement area

While CMO played an important role in developing a CSI methodology, using Sec. 309 program funding, operational responsibility was transferred to EQB by mutual agreement between the two agencies. Accordingly, PRCMP will not develop an enhancement area strategy for this cycle but will provide support to OGPe and seek to establish agreements and MOUs to ensure implementation of PRCMP enforceable policies.

SPECIAL PLANNING AREA MANAGEMENT ASSESSMENT

Section 309 Enhancement Objective

Preparing and implementing special area management plans for important coastal areas

Context for SPA Management

DNER's recommendation for designation of the Northeast Corridor as a natural reserve has been approved by the PRPB. The announcement of the designation of the Northeast Corridor and a new Special Planning Area initiated the Public review period. PRPB will conduct a public hearing on the designation scheduled for January 18th, 2011.

Resource Characterization

The Puerto Rico Coastal Zone Management Program defines Special Planning Areas as "important coastal resource areas subject to serious present or potential use conflicts, and, therefore, requiring detailed planning." Eight Special Planning areas were adopted as part of the PRCMP in 1978.

SAMPs provide public and private development guidance. PRCMP currently funds the development of SPA management plans under Section 306 as an active program task. SPA management plans usually identify best management practices for each land use category and may include recommendations for new natural reserve designations or boundary changes of existing SPAs. Once adopted by the PRPB and approved by the Governor, SPA management plans are adopted as part of the Island-wide Land Use Plan. Policies established through SPA management plans are integrated as a part of Municipal Land Use Plans that also require PRPB approval.

In 1978 PRCMP identified 26 candidate areas for designation as natural reserves. As of 2010, DNER had submitted 35 recommendations for natural reserve designation of which 34 have been approved by the Puerto Rico Planning Board (PRPB). The Puerto Rico Legislature has also adopted, via special statutes, seven natural reserves< although not all are coastal or marine reserves.

Geographic Area	**Major conflicts**	**Is this an emerging or a long-standing conflict?**
Northeast	• Boundaries definition of proposed designation of NE	The northeast region of Puerto Rico comprises an important array of natural

	natural reserve • Intensive use of coastal waters for recreational navigation This region hosts 75% of the marinas and 45,000 registered boats in Puerto Rico. • Coastal waters sedimentation	resources. Among other, El Yunque National Forest as well as several natural reserves have been designated by DNER under the PRCMP due to their importance to protect wetlands and coral reef communities. Increased in resorts and secondary homes projects have increased sediment loadings to coastal waters and pressure to coastal and marine habitats. The Northeast Corridor natural reserve will contribute to effectively manage and reduce pressure on these systems. There are controversies between communities, NGO and government agencies about the reserve's boundaries definitions. PRPB and DNER proposed an integrated Natural Reserve and Special Planning Area regulating all uses at the Sabana, Pitahaya, and Juan Martin river watersheds.
Southeast region	Coastal and shoreline erosion and sedimentation	Sediment loadings to coastal waters have increased due to increase in precipitation and floods impacting areas that were infrequently flooded. Shoreline erosion is associated to structures affecting the sediment budget of several coastal segments (i.e., Arroyo). PRCMP envisions that the problem will increase Island-wide due to rising sea level. Preparation of the PRCMP SPA management plan for Pandura-Guardarraya has not been initiated.

Southwest region	. Boating access constraints . Coastal waters sedimentation . Shoreline erosion	The Southwest region of Puerto Rico hosts the second largest number of boats in Puerto Rico. Traditionally boating access has been limited. There is a pressing need to improve access to navigation. Illegal boat ramps and accesses induce impacts on coastal vegetation and wetlands. Erosion and sedimentation are one of the major stressors of coral reef communities in Puerto Rico. Land based sources of pollution control are addressed through SPA management plans. A pilot watershed initiative is coordinated with Federal, Commonwealth, local governments and the community at Guanica Bay watershed. La Parguera, Guanica and Boqueron SPA plans have been completed. These PRCMP plans include management options to address these issues.
Northwest region	Increase on Urban Development at the Isabela, Aguadilla Special Planning Area. Shoreline erosion at Rincon. Sedimentation of the marina at Rincon.	Construction of secondary homes and resorts have increased pressure on sand dunes and wetlands resources of the NW region. Coastal erosion at Rincon continues at a rate of 3 ft beach loss in some coastal reaches. Winter swells, hasdening of the shoreline as well as impacts to sediment inputs have affected the sediment budget for the region. UPR and CaariCOOS initiated the modeling of alternatives to reduce wave energy and induce tombolo

		formation coupled with sand nourishment of the area. The Rincon municipality supports this initiative, The Quebradilla, Isabela and Aguadilla SPA management Plan was completed and is pending adoption by PRPB. Several long standing issues were addressed through plan preparation.

1. Geographic areas in the coastal zone subject to use conflicts that can be addressed through special area management plans (SAMP) including areas where SAMPs have already been developed

Table 1: SAMP designated and SAMP candidate areas

SAMP title	**Status (new, revised, or in progress)**	**Date approved or revised**
1. All Mangrove Areas SPA	Completed	Designated: 1978 Plan adopted and approved: 2001
2. Boca de Cangrejos (Piñones) SPA	Completed	Designated: 1978 Adopted PRPB: 1992 Approved Governor: 1994
3. Pandura-Guardarraya SPA	Pending	Designated: 1978 Adopted: Pending Approved: Pending
4. Jobos Bay SPA	Draft management plan under review (ongoing)	Designated: 1978 Adopted: Pending Approved: Pending
5. Southwest SPA	Subdivided into 3 segments: Guanica , La Parguera , Boqueron-Cabo Rojo .	Designated: 1978 La Parguera segment

	La Parguera SPA: Completed Guanica: Under PRPB review Boqueron-Cabo Rojo: PRPB review.	Adopted: 1995 Approved: 1995 Guanica segment: Pending Boquerón: Pending
6. Isabela SPA	Completed. Public hearings . Pending approval by PRPB and adoption by Governor.	Designated: 1978 Adopted: Pending Approved: Pending
7. Laguna Tortuguero SPA	Completed	Designated: 1978 Adopted: 1993 Approved: 1994
8. Vieques SPA	Draft management plan completed and will be submitted for DNER and PRPB technical review	Designated: 1978 Adopted: Pending Approved: Pending
9. Northeast Corridor SPA	Natural Reserve recommendation submitted by DNER. A new SPA to be established ed by PRPB. Public review period: ongoing (2011).	2010 pending final adoption by PRPB and Approval by Governor once Public Review process and official hearings are completed. PRCMP will submit RPC once the process is considered completed by PRPB.

Management Characterization

Purpose: To determine the effectiveness of management efforts to address those problems described in the above section for the enhancement objective.

1. The approach employed in addressing significant changes since the last assessment

Table 2: Use of management categories and changes since last assessment

Management Categories	**Employed by state/territory** (Y or N)	**Significant changes since last assessment** (Y or N)
Regulations	Y	N
Policy	Y	N
Guidance	Y	N
Management Plans	Y	Y
Research, assessment, monitoring	Y	Y
Mapping	Y	Y
Education and Outreach	Y	Y

2. Significant changes since the last assessment

DNER's recommendation for designation of the Northeast Corridor as a natural reserve has been approved by the PRPB. The announcement of the designation of the Northeast Corridor and a new Special Planning Area initiated the Public review period. PRPB will conduct a public hearing on the designation scheduled for January 18th, 2011.

Priority Needs and Information Gaps

Table 2: Priority needs and information gaps

Gap or need description	**Type of gap or need (regulatory, policy, data, training, capacity, communication & outreach)**	**Level of priority (H,M,L)**
Strategies to address conflicts between competing land uses and resource users.	Improve communication and outreach skills to improve conflict resolution	H

Effective management tools to imrpove coastal resources protection in privately owned areas.	Policy, regulatory, conflict resolution strategies.	H
Education and Outreach	Training and strategies development	H
Marine Protected Areas Planning	Training in monitoring, surveillance, and enforcement	H
Long-term monitoring of coastal and marine ecosystems, habitats and species (potential climate change impacts on MPA refugia)	Training in data collection, monitoring, data analysis	H

Enhancement Area Prioritization

1. Priority ranking

High

Medium: X

Low

2. Justification

Although Federal and Commonwealth agencies' partners and stakeholders recognize the importance of sound sub-regional and watershed planning there were other enhancement areas identified as higher priorities for Sec. 309 program funding. In addition, Special Planning Area activities are covered under the 306 program. PRCMP will continue supporting planning and active management efforts for the eight designated areas and the new Northeast Corridor SPA .

3. The CMP will not develop strategies for this enhancement area

Since adoption of the PRCZMP in 1978 the SPA process has been used for integrated coastal area management. SPA plans have been used as effective mechanisms to address conflicts and promote sustainable uses and the protection of critical habitats and wildlife. PRCMP will continue SPA planning as a Section 306 management activity. New challenges include

adapting to the new Permit System created by Law 161 of 2009 and its associated Joint Permit Regulations.

PROGRAM ENHANCEMENT STRATEGIES

WETLANDS STRATEGY

I. Issue Area(s)

The proposed strategy or implementation activities will support the following priority (high or medium) enhancement area(s) *(check all that apply)*:

( ) Aquaculture
( ) Cumulative and Secondary Impacts
( ) Energy & Government Facility Siting
(X) Wetlands
( ) Coastal Hazards
( ) Marine Debris
( ) Ocean/Great Lakes Resources
( ) Public Access
( ) Special Area Management Planning

II. Program Change Description

A. The proposed strategy will result in, or implement, the following type(s) of program changes (check all that apply):

( ) A change to coastal zone boundaries; New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;
( ) New or revised local coastal programs and implementing ordinances;
(X) New or revised coastal land acquisition, management, and restoration programs;
( ) New or revised Special Area Management Plans (SAMP) or plans for Areas of Particular Concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
(X) New or revised guidelines, procedures and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government and other agencies that will result in meaningful improvements in coastal resource management.

Major program changes in wetlands management are projected for the next cycle of Sec. 309 program activities. These program changes will constitute building blocks of a Strategic Plan for Coastal Wetlands Management and Restoration SPCWMR. The projected program changes build on the work that was conducted during the 2005-2010 program period during which: (1) A wetlands inventory was completed as part of a legislative mandate required by Law 314; (2) Zoning districts for marine wetlands were delineated along the south coast, and; (3) Technical and professional reports and presentations related to marine and coastal zoning were widely distributed together with educational outreach materials.

This analytical, mapping, and organizational work provides the underpinning for preparation of the SPCWMR to be completed during the 2011-2015 program cycle.

The strategy 2011-2015 will concentrate on the development and implementation of a SPCWMR, the strategic plan will serve as both:

- An integral part of the Island-wide Land Use Plan to be adopted by the Puerto Rico Planning Board.(PRPB) and;
- A component of the Sub Regional Coastal and Marine Spatial Plan SRCMSP, a major planning component of the PRCZMP.

Program changes that will be incorporated into the Strategic Plan include the following, among others.

In general, PRCMP will aim at reaching increased coordination between regulatory agencies as well as improved coordination of outreach, educational, extension services and management activities between Federal and Commonwealth agencies charged with wetlands management and administration. To that effect PRCMP will propose to expand the Coastal Interagency Wetlands Committee (CIWC) created in 2008, to integrate relevant Federal agencies such as: USFWS, NRCS, USEPA and USACE. Specific components of the (SPCWMR) must be also coordinated with relevant stakeholders and municipalities. The Interagency Committee will seek to increase and synthesize knowledge on watershed characteristics and wetlands science into a strategy for coastal wetland protection and restoration based on developed goals.

DNER is the lead agency for the conservation, management, and administration of submerged lands beneath Puerto Rico's territorial waters. In the past, PRCMP has proposed amendments to Regulation 4860 (1992) in order to standardize use fees. In addition, PRCMP has developed zoning proposals that DNER envisions will be highly useful in the discussions of the Puerto Rico segment of the U.S. Caribbean Regional Ocean Planning initiative. During FY 2011.President Obama signed Executive Order #13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes in July 2010, and committed the nation to the development of a National Ocean Policy and to the use of a planning process for use and stewardship of our ocean and Great Lakes that incorporates the principles of marine spatial planning and ecosystem-based management. To kick-off the CMSP process a National Workshop has been planned for June 21-23rd, 2011 in Washington, DC. PRCMP Director and Wetlands Strategy coordinator will participate of this initiative. Relevant policy design tools promoted through this initiative will be integrated to the proposed wetlands policies and program changes to be developed during FY2011-2015.

PRCMP will continue to spearhead efforts for a shared understanding of CMSP as framed by the National Ocean Policy. CMSP will serve as the guide to address wetlands issues related to recreational and commercial activities, fishing, boating, development, resource management, shipping, national security, human health, coastal planning, agriculture, energy and utilities.

PRCMP envisions that several elements of the strategic plan will constitute a program changes per addressed in the program change section of the strategy:

- The SPCWMR will be developed as a component of the Puerto Rico segment of the Sub Regional Coastal and Marine Spatial Plan (SRCMSP) and will be submitted to the PRPB for adoption as part of the Puerto Rico Island-wide Land Use Plan.

- New wetlands protection or sustainable use policies will be integrated changes as part of the overall PRCZMP objectives.
  Wetlands and wetland functions are inextricably linked to their surroundings, particularly human systems and therefore, wetland conservation must be pursued in the context of sustainable development. Examples of possible "sustainable use policies" for Puerto Rico's wetlands include low intensity of cultivation and grazing in agricultural areas, management of flow and drainage for multiple use areas, spatial rotation of land uses causing different parts of a wetland to be under different uses every few years, etc.

III. Needs and Gaps Addressed

The primary focus of the 2011-2015 309 activities for the SPCWMR will be the strategic planning of coastal-intertidal wetlands. Coastal-intertidal wetlands are areas along the shoreline that are exposed at low tide and submerged at high tide. However, CMSP requires the recognition of the connectivity and interdependence of all wetland systems. To that effect, PRCMP will primarily fund coastal-intertidal strategic planning in coordination with the CIWC and will continue gathering all relevant information arising from CMSP and coral reef related programs and processes.

In the Assessment the following needs were identified that this strategy specifically seeks to fulfill:

- A "Comprehensive Plan for the Management and Restoration of Coastal Wetlands" in order to identify potential, feasible mechanisms and develop guidelines considering institutional issues with respect to agency roles and responsibilities for wetland protection, restoration and mitigation.

- Outreach and communication

The strategy for the wetlands component also addresses the following additional needs:

- Promote the conservation of wetlands through sustainable development activities.
- Improve interagency coordination including the coordination of the implementation of erosion and sediment control requirements on agricultural lands by the PRPB and EQB.
- Provide guidelines and seek Joint Permit regulations amendments geared to protect wetlands ecologic and coastal hazards amelioration values and functions.
- Development of coastal habitat restoration strategies and monitoring plans.

IV. Benefits to Coastal Management

- Synthesize knowledge of watershed characteristics and wetland protection programs into a strategy for wetland protection and restoration based on developed goals.
- Improved protection of wetlands based on a strategic approach for wetlands protection through designation of natural reserves and zoning districts regulations
- Improved protection of wetlands through private land owner's conservation practices based on Federal and Commonwealth incentives, guidelines and outreach efforts led by PRCMP.

- Improve the opportunities for socio-economic development through sustainable use of wetlands under the proposed "Adopt a Wetland Bill" strategy to be developed by PRCMP.
- Improved technical evaluation of potential use of wetlands under the new Permit system administered by OGPe.
- Reduction of permit evaluation timeframes.

V. Likelihood of Success

Support for this strategy exists at the municipal, Commonwealth and Federal levels and PRCMP is confident that past work in building relationships, compiling information, and the five-year work plan will be sufficient to achieve the goals of this strategy.

Under Puerto Rico Executive Order 2008-53, the Coastal Wetlands Interagency Committee (CWIC) was created for the Protection of Wetlands. Participating agencies, DNER, PRPB, Department of Agriculture, National Parks Company, Land Authority, State Police, and The Office of Municipal Affairs, will be key players in developing the (SPCWMR). Effective coordination with local coastal planning officials already exists from previous work conducted during the past 309 program cycle which laid the basis for further collaboration between CMO and local entities. These relationships will prove useful for support and assistance to complete the SPCWMR, program tasks, the other program changes, and implementation of recommended actions.

Under U.S. Executive Order #13547, Stewardship of the Ocean, Our Coasts, and the Great Lakes in July 2010, President Obama committed the nation to the development of a National Ocean Policy and to the use of a planning process for use and stewardship of our ocean and Great Lakes. The Interim Framework recommends that CMSP planning occur within a set of new regional planning bodies, the recommended new structures would be carried out by federal, states, local and tribal authorities under existing applicable statutes.

PRCMP will initially incorporate the principles of marine spatial planning and ecosystem-based management through Sub Regional Marine Spatial Planning Committees. Key players in these committees will be integrated by Professional Planners from coastal municipalities, Scientific Advisors from Academic Institutions and intergovernmental agencies, along with identified stakeholders. At the same time, PRCMP will continue to work in coordination with the Government of the U.S. Virgin Islands, the U.S. Fish and Wildlife Service, NOAA's National Marine Fisheries Service, PRPB, PREQB and DNER to develop the U.S. Caribbean Region Ocean Planning and Landscape Conservation Initiatives,

In addition to the PRCMP Director and Wetlands Strategy coordinator, DNER Secretary, PRPB President, EQB President and the Executive Director of the Puerto Rico Energy Affairs Administration or their representatives will be participating at the National Workshop planned by the White House for June 21-23rd, 2011 in Washington, DC.

A five–year period is a reasonable time frame for the accomplishment of a project of this nature that requires intergovernmental and consolidating working relationships with other levels of

government. Specifically, we will focus on facilitating the adoption of the program changes by OGPe, PB and others. Communications in 2010 about the Joint Permit Regulation laid the foundation for such collaborations.

6 Strategic Work Plan

The adoption and implementation of the strategy requires the completion of the activities described for the following years.

YEAR 1 2011

Description of activities

Literature review of educational and management strategies about wetland protection and restoration programs from other states and territories to evaluate and select the best management practices. Synthesize knowledge of watershed characteristics, topography, hydrology, water quality, biological interactions and wetland protection regulations and agencies programs relating to wetlands (Federal Regulatory Programs, Commonwealth Regulatory Programs, Federal–Local Commonwealth Interactions, Local Government Regulatory Programs) into a strategy for wetland protection and restoration based on existing management practices and developed goals and concerns; modifying regulations for wetlands and mangroves and changing water quality standards. CMSP information is a strategic asset for the SPCWMR, the web center will be used to collect and disseminate non confidential CMSP and SPCWMR data products and services to the general public (stakeholders), and must be developed and managed on an ongoing basis to meet planning needs, Use the CMP GIS to identify the geographic distribution of wetlands managed by government and private lands, verify who are the owners using the CRIM baseline data. Validate information through field inspections. Coordinate with the OGPe and the Federal Consistency Office of the PRPB the recompilation of Joint Permit data to update the status and trends of wetlands. The web center will be used to promote an understanding of the results to city and county officials, relevant state and federal agencies, NGOs, non-profit organizations, universities and other public and private interests. Initiate the development and coordination of a wetlands adoption and educational program (WAEP). Integration of stakeholders, academia and intergovernmental agencies through conferences, and outreach activities to raise general awareness.

Outcomes:

- Technical report of the SPMRCW - first year
- Technical report of the WAEP- draft
- Operation of the web-center (Contract)
- Annual conference on Coastal and Marine Spatial Planning

BUDGET YEAR 1: $ 86,000.00

Personnel: $ 56,000.00.00
Contract: $15,000 Data Management Center

Workshops: NO COSTS INVOLVED
Conferences and seminar venues: $ 15,000
Facilitator/translation services: NO
Publications: NO

YEAR 2: 2012

Description of activities:

PRCMP and CMO will coordinate the creation of local (CWIC) including stakeholders to evaluate and classify the ecological value and actual conditions of wetlands using the official evaluation matrix developed by the DNER. Integration of intergovernmental agencies (NCRS, USFWS, COE), private sector and stakeholders into multidisciplinary efforts to promote technical evaluation of potential use of wetlands and socioeconomic development through sustainable use of resource characteristics and limitations. Identification and assessment of wetlands functions, values, hazards and other features relevant to determining appropriate and suitable use. Identify what type of zoning districts of the island wide use plan of the JP and territorial plan of local municipalities were assigned to wetlands. Review and analyze if designated uses and restrictions provide appropriate protection. Review boundaries or use policies for SPAs or NRs. Delineation of zoning districts and proposed use regulations. Data from the acquisition and transfer of (Commonwealth) agency-owned wetlands to DNER for preservation in perpetuity; acquisition of development rights from private owners in exchange for taxation or other financial incentives will be operated and maintained through the wet- data-center. Integration of stakeholders, academia and intergovernmental agencies trough conferences, and outreach activities to raise general awareness.

Outputs:

- Technical report of the SPMRCW - 2nd year
- Recommendations to Zoning Districts Regulations
- Technical report of the WAEP- revised draft
- Development of educational and outreach material
- Operation of the web-data center
- Annual conference on Coastal and Marine Spatial Planning

BUDGET YEAR 2: $78,500

Personnel: $ 56,000.00
Contract: NO
Workshops: NO COSTS INVOLVED
Conferences and seminar venues: $ 10,000
Facilitator/translation services: NO
Publications: $ 12,500

YEAR 3: 2013

Description of activities:

During this year the main focus will be to improve technical evaluation of potential use of wetlands at regulatory agencies. The DNER SIG data will be used to classify, evaluate and analyze criteria and conditions used in approved joint permits. An overview of mitigation processes and procedures will include the review of types of mitigation like, avoidance, enhancement restoration and creation. In-Lieu Fees and Wetland Mitigation Banks. Mitigation Ratios. Effectiveness of Enhancement and Restoration. Designing an Effective Enhancement or Restoration Plan .Contents of an Enhancement or Restoration Plan. Basic Standards for a Monitoring Plan. PRMCP-CMO will coordinate workshops with relevant stakeholders and intergovernmental agencies to evaluate documented opinions on potential wetlands use, acquisition and integration of best management practices. Analyze and develop appropriate management goals for designated uses in selected areas and regulations for OGPe. The Coastal Wetland Interagency Committee will coordinate the final drafting of the SPCWMR based on documented opinions and adopted best management practices. PRCMP-CMO will use guidelines to seek amendments to the sections of the Joint Permit Regulations geared to protect wetlands ecologic and coastal hazards amelioration values and functions. An environmental lawyer will be retained to support CMO in developing recommendations for amendments of joint permit regulations and related laws.

Outcomes:

- Strategic Plan for Coastal Wetlands Management and Restoration (SPCWMR), with guidelines geared to protect wetlands ecologic and coastal hazards amelioration values and functions. - Final
- Legal Recommendations for Amendments to JP Regulations (Lawyers Contract)
- Multiple Interagency workshops.
- Operation of the web data center
- Develop outreach and educational material
- Annual conference on Coastal and Marine Spatial Planning. (Presentation of the SPCWMR)

BUDGET YEAR 3: $88,500

Personnel: $ 56,000
Contract: $10,000 (Lawyer)
Workshops: NO COSTS INVOLVED
Conferences and seminar venues: $ 10,000
Facilitator/translation services: NO
Publications: $ 12,500

YEAR 4: 2014

Description of activities

During the 4th Year the Coastal Wetland Interagency Committee will initiate the implementation of the (SPCWMR) based on documented opinions and adopted best management practices including the following among others:

- Initiate modification of Joint Permit Regulations and other relevant existing regulations governing the use of wetlands and the protection of wetlands resources affecting cutting of mangroves, hunting in wetlands, and harvesting of shellfish in coastal wetlands, among others.
- Guidelines, standards and criteria for evaluating the development impacts on different classes of wetlands and benthic communities, for incorporation into the permitting review and evaluation process to be used by regulatory agencies such as the PRPB, PREQB, OGPe, and DNER.
- Acquisition and transfer of (Commonwealth) agency-owned wetlands and submerged lands to DNER for preservation in perpetuity; acquisition of development rights from private owners in exchange for taxation or other financial incentives.
- Review and proposed changes in water quality standards based on impacts on wetland ecosystems from upland runoff, point source discharge, and stream flow sedimentation loads; provisions for monitoring of water quality standards by public agencies in wetland and submerged lands.
- Enforcement; review of current effectiveness and recommendations for increased fines and other penalties for wetlands infringement, degradation or destruction, to be incorporated as amendments to existing laws
- Providing for economic opportunities without compromising coastal and marine wetland resources such as zoning designations and the "Adopt a Wetland" bill.

DNER recognizes that the Commonwealth cannot purchase all important natural resource areas. Many wetland areas are located on private lands. The Adopt a Wetlands bill would create incentives for conservation and/or restoration of the values and functions of wetlands. PRCMP-CMO would retain a lawyer to help with the bill preparation and with the identification of all economic incentives and legal mechanisms to foster private owners protection of coastal wetlands. The result would be a voluntary program that provides technical and possibly the reduction or exemption of property taxes to eligible landowners to address wetland, wildlife habitat, soil, water, and related natural resource concerns on private and public lands in an environmentally beneficial and cost-effective manner.

Outputs:

- Provide technical assistance to OGPe and local governments in decision making
- Develop outreach and educational materials of the SPCWMR
- Multiple Interagency workshops.
- Operation of the web data center
- Annual Conference on Coastal and Marine Spatial Planning. (Status of the SPCWR)
- Draft "Adopt a Wetland" Bill

BUDGET YEAR 4: $ 88,500.00

Personnel: $ 56,000
Contract: $ 12,500 (Lawyer for Adopt a Wetland Bill and analyses of opportunities for wetlands conservation incentives on private lands)
Workshops: NO COSTS INVOLVED
Conferences and seminar venues: $ 15,000
Facilitator/translation services: NO
Publications: $ 5,000

YEAR 5: 2015

Description of activities

During the 5th year, PRCMP-CMO will continue the implementation of the (SPCWMR) as a component of the PRCZMP consolidating identified policies and zoning regulations, potential boundary and land use policy modification to SPA and Natural Reserve management plans, as well as changes to local Territorial Plans that encompass wetland areas. Submit to the PRPB recommendations to Incorporate zoning districts into the Land Use Plans or modify and improve zoning districts, guidelines and management practices of the (SPCWMR) into the permitting review and evaluation process conducted under the newly adopted Joint Permit Regulations. Particularly adoption of changes to the Island-Wide Land Use Plan and other elements of the coastal zone management program (CZMP). Its implementation is highly dependent on the will of senior level decision makers and funding levels at each of the participating agencies and organizations. CMO will continue to promote the annual MSP conference, other activities designed to raise public awareness and influence decision makers, conducting multiple workshops and trainings to local governments, professional associations, and regulatory agencies on the importance of coastal habitats and sustainable use of wetlands. Habitat protection and restoration is a key element of the CZM act. The CZMA directs states coastal programs to "preserve, protect, and whenever possible, to restore and enhance the resources of the nation coastal zone for the benefit of future generations" (CZMA, 1978 as amended). CMO will coordinate the creation of voluntary restoration programs through local communities, landowners, environmental groups, schools and universities. Integrate local communities in land use planning techniques to prevent wetland deterioration, through the protection and restoration of the natural services provided by wetlands. Preparation of the

draft assessment of the SPCWMR .The outreach and educational material will be used to effectively communicate the (SPCWMR) through its outreach program.

Outcomes:

- Assessment of the SCWMR implementation- Draft
- Provide technical assistance to OGPe and local governments in decision making
- Brochures, maps and updated educational information dealing with wetlands values and functions
- Multiple Interagency workshops
- Operation of the web-data center
- Wetlands Adoption Report for year 2012-2015
- Annual Conference on Coastal and Marine Spatial Planning .(SPCWMR Assessment)

BUDGET YEAR 5: $ 88,500.00

Personnel: $ 56,000
Contract: NO
Workshops: NO COSTS INVOLVED
Conferences and seminar venues: $ 15,000
Facilitator/translation services:
Publications: $17,500 (Spanish and English versions of all material produced during years 4 and 5)

7 Fiscal and technical needs

N/A

COASTAL HAZARDS STRATEGY

Coastal Hazards Vulnerability Assessment and Adaptation Strategy for New Public Policies

I. Issue Area

The proposed strategy or implementation activities will support the following priority (high or medium) enhancement area(s) *(check all that apply)*

O Aquaculture
O Energy & Government Facility Siting
X Coastal Hazards
O Ocean/Great Lakes Resources
O Special Area Management Planning
O Cumulative and Secondary Impacts
O Wetlands
O Marine Debris
O Public Access

II. Program Change Description

A. The proposed strategy will result in, or implement, the following type(s} of program changes *(check all that apply):*

o A change to coastal zone boundaries;
x **New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;**
0 New or revised local coastal programs and implementing ordinances;
0 New or revised coastal land acquisition, management, and restoration programs;
X New or revised Special Area Management Plans (SAMP) or plans for Areas of Particular Concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
X New or revised guidelines, procedures and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government and other agencies that will result in meaningful improvements in coastal resource management.

III. Needs and Gaps Addressed

Identify what priority need the strategy addresses, and explain why the proposed program change or implementation activities are the-most appropriate means to address the priority need. This discussion should reference the key findings of the Assessment and explain how the strategy addresses those findings.

Coastal hazards need to be elevated as a priority in the Commonwealth of Puerto Rico in order to obtain the policy, management, financial and institutional support that it needs to address

these critical issues. This sentiment has been clearly articulated by participants at numerous CMO meetings and dialogues since the last sec. 309 assessment and strategy. This Coastal Hazards Strategy reflects the important gaps that have been identified through numerous discussions and collaborations over the years.
Specifically, sound public policies and regulations should be codified in Puerto Rico and certain hazard mitigation approaches should be undertaken by the Commonwealth. This strategy has been developed with a focus on creating a robust foundation of critical data, collaboratively developed and advocated mitigation approaches for a variety of stakeholders (including policies and regulations for Commonwealth and municipal governments) for adoption and implementation, and education-outreach efforts to reduce risks to life and property and to foster the needed push for policy and regulation actions related to these issues.

The Coastal Hazards Enhancement Area Assessment identified a need to address current hazards (i.e. storm surge, erosion, flooding, etc) as well as climate variability and change at the territorial level since there currently does not exist a Puerto Rico-wide vulnerability assessment or adaptation plan. This strategy will complete the risk assessment and guide the development of adaptation strategies for multiple targets (namely government and the private sector). Guidance, in the form of the best available scientific knowledge and recommended risk reduction strategies, will be developed for all levels of government. This will be accomplished in order for Commonwealth and local governments to incorporate coastal hazard data into their plans, regulations, projects, policies, special area management plans, and future post-disaster development plans. The creation of this vulnerability assessment and recommendations for adaptation strategies for the purposes of this document is called the “Climate Change Vulnerability Assessment and Adaptation Strategy”. Specifically needed to advance work in this issue area is a comprehensive coastal hazard and geomorphic feature database and library that can be used to assess risks to the coasts. There is an increasing need to identify coastal features that provide current protection to coastal communities. Once this work is complete the PRCMO would begin advocating for the needed policies. Specifically, the PRCMO would work on guidance for standards and design considerations for modifications of natural and man-made features in coastal high hazard areas.

Subsequently, with the aid of legal consultation, legislation will be drafted and submitted to the Commonwealth legislature. The CZM Program will advocate for the adoption of this legislation by presenting legislative testimony on the risks and vulnerabilities of person and structures from hazards and climate change and increasing the effectiveness of our outreach and communications. An important piece of getting executive and legislative support for the program changes is to increase official and constituent support through outreach and communication efforts.
These vital and important tasks, and implementing an education and outreach plan are critical components of a coastal hazards strategy to build coastal resilient communities.

IV. Benefit(s) to Coastal Management

Discuss the anticipated effect of the program change or implementation activities including a clear articulation of the scope and value in improved coastal management and resource protection.

This strategy will have three principal effects. First, the project will provide much needed data in a usable format, specifically the Coastal Hazards Database, to guide future planning and project development to a variety of stakeholders. Second, the strategy will foster a more aware, more engaged, and eventually more “resilient” Puerto Rican public. And third, it will lay the groundwork for future adoption of effective hazard mitigation policies and actions by the

Commonwealth and relevant resource users. The goal is for the CMO through the completed coastal zone vulnerability assessment and recommended adaptation strategies to encourage and advocate for the designation of coastal hazards and climate change impacts as issues that must be considered when developing design standards, Commonwealth plans and policies, hazard mitigation plans, development projects, local mitigation strategies, civil society activities, etc. Having the necessary assessments, recommendations, and backing of the Puerto Rican public will increase the political will to implement much-needed policies and regulations. Through partnership building and inter-agency collaboration this valuable information may be translated into adoption at different levels of society.

V. Likelihood of Success

Discuss the likelihood of attaining the proposed program change and implementation activities. The state or territory should address: 1) the nature and degree of support for pursuing the strategy and the proposed change; and, 2) the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.

The likelihood of success for this strategy is strong because the project will build upon existing work by both CZM-efforts and non-CZM efforts, as well as CMO's vast experience and partnerships. On the basis of repeated experience with coastal floods, hurricanes, and related events, the Commonwealth has a healthy respect for coastal hazards and their consequences, and, over time, has initiated significant mitigation measures including large-scale relocation. DNER's strength lies in its knowledge base of coastal conditions and its past work in mitigation planning. Additionally, this project is centered around multi-stakeholder collaboration and will have project partners with great technical resources, such as the Caribbean Coastal Ocean Observing System (CariCOOS), the Caribbean Tsunami Center, The Coastal Hazards Center of Puerto Rico, the Puerto Rico Seismic Network, Puerto Rico Sea Grant, the National Weather Service, the Puerto Rico Emergency Management Agency, and the University of Puerto Rico. Each of these organizations are committed to the development of the vulnerability assessment and to recommending actions. Additionally, each group is committed to advocating for the adoption of these documents and recommendations by Commonwealth and local governments.

CMO is cognizant of constraints to successful program outcomes which may be enumerated as follows:

a. Resource availability

Program resources, both personnel and budgetary, must be adequate to the task. Because the budget is limited, an effort must be made draw on parallel resources in other agencies and project partners, both Commonwealth and Federal. This will require both skill and experience on the part of the task leader and careful direction and support from CMO management. Fortunately, through the NOAA Coastal Management Fellowship Program we are guaranteed a graduate fellow for two years of the project to serve as a co-project manager with the CMO Director.

b. Diversity of stakeholder interests

Stakeholder opposition to new design standards on coastal setbacks, building elevations, designation of high vulnerability areas, building prohibitions, and other adaptation strategies are likely to create political impediments to the enactment of measures. Any opposition needs to be

countered by effective outreach and public education. There needs to be maximum dialogue with stakeholders in the formative phase, from the beginning of the vulnerability assessment to the formulation of adaptation strategies. Without active stakeholder involvement, sound science, and advocacy by the CMO and partners political opposition could be formidable.

c. Access to senior level decision makers

At key points, the top levels of DNER, PB, and representatives of the Governor's office will need to be involved in the review of issues and policy directions since the resolution of coastal hazard vulnerability issues go well beyond technical considerations. Without senior level involvement and support, technical staff will find it difficult to move program recommendations to the implementation stage.

By collaborating with multiple partners the outcomes of the strategy will have a higher probability of widespread support due to enhanced scientific robustness and stakeholder-supported management recommendations. The realities of potential opposition force a large emphasis on collaboration. Multiple voices from a variety of sectors will assist with reaching out to key decision-makers, the public, and the private sector.

The above actions will maintain or build future support for achieving and implementing the Program change. More specific actions (that may or may not require Section 309 funds) include:

- Convene and engage a task force of partners and expert advisors throughout the process. Support and encourage their active participation in this effort.
- Incorporate a peer-review process into the vulnerability assessment to ensure sound science is used to develop hazard mitigation and climate adaptation strategies.
- Develop outreach and communication materials to educate about coastal hazards, explain the reasoning for recommended policies and strategies, and garner support for such work.
- Stakeholder listening sessions and risk assessment workshops will be held to obtain key inputs for the process and to foster support for outputs.
- Take advantage of opportunities provided by conferences, meetings, workshops to present the work. When the strategy outputs are completed use these forums and others to widely disseminate and advocate.

VI. Strategy Work Plan

Using the template below, provide a general work plan that-includes the major steps necessary for achieving the program change and/or implementing a previously achieved program change. The plan should identify significant projected milestones/outcomes, a schedule for completing the strategy, and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual outcomes are a useful guide to ensure the strategy remains on track, OCRM recognizes that these benchmarks may change some over the course of the five-year strategy due to unforeseen circumstances. The same holds true for the annual budget estimates. If the _ Uitends to tqnd implementation activities for the proposed program change, describe those in the plan as welL Further detailing of

annual tasks, budgets, benchmarks, and work products will be determined through the annual award negotiation process.

Scope of Project

The first two years of the program will focus on developing a Coastal Zone Vulnerability Assessment and Adaptation Strategy as part of the PRCZMP's Puerto Rico Coastal Adaptation Project. The NOAA Adaptation Guide lays out a number of definitions related to such work. There are numerous definitions for the term "vulnerability" and it is often used interchangeably with, or as a part of, "risk". The program's intent is to also capture both risk and vulnerability into the Puerto Rico vulnerability assessment. "Vulnerability" can be defined as the potential loss of or harm/damage to exposed assets largely due to complex interactions among natural processes, land use decisions, and community resilience. The NOAA advised process for conducting vulnerability assessments includes: (1) identifying climate change phenomena; (2) identifying climate change impacts and consequences; (3) assessing physical characteristics and exposure; (4) considering adaptive capacities; (5)developing scenarios and simulating change; and (6) summarizing vulnerability and identifying focus areas. The PRCZMP, in collaboration with multiple partners, will go through this process to complete the Coastal Zone Vulnerability Assessment within the first two years of the program. Subsequently, adaptation strategies will be recommended through stakeholder input and in collaboration with the partners, and the remainder of the five years will be devoted to implementation and outreach. Adaptation strategies use the vulnerability assessment to recognize the impacts that are likely to affect certain planning areas, develop goals and actions to best minimize the impacts from climate change and establish a process to implement those actions. It is the intention of the PRCZMP to consider multiple hazards during this process, in addition to the ones caused by or exacerbated from climate variability and change.

Over the course of the five years the program will:

- Collect the best available scientific knowledge and combine with new data to create the Puerto Rico Coastal Hazards Database and Library;
- Conduct a comprehensive vulnerability assessment with multiple partners;
- Foster networking and interagency collaboration and implementation (through multiple methods but specifically recurring meetings with key players and an annual partnership meeting), and;
- Effectively communicate these hazard analyses and adaptation strategies through an education and outreach plan to communities, agencies, and the private sector.
- Develop climate variability and change adaptation strategies with multiple partners and stakeholder input;
- Recommend standards and design considerations for modifications of natural and man-made features in coastal high hazard areas;

- Revise current building setbacks and design elevations for private and public infrastructure development in coastal high hazard areas and provide OGPe with specific recommendations to revise Joint Permit regulation developed under Law 161, Amendment recommendations for Coastal Public Trust Lands and Maritime Terrestrial Zone Regulation (Regulation 4860) and Building Codes will be developed by CMO and the Puerto Rico Professional Engineers Association and relevant working groups as part of the PRCCC initiative.

Final Outcome(s) and Products: (1) Identification of an assessment methodology to analyze climate variability and change impacts to Puerto Rico and to determine the most vulnerable communities, infrastructure/ assets, and ecosystems; (2) analysis and prioritization of potential hazard mitigation and climate adaptation strategies; (3) a GIS-based Coastal Hazards Database and Library; (4) a vulnerability assessment and adaptation strategy; (5) guidance for design standards for natural and man-made features in areas subject to coastal flooding; (6) new draft legislation for certain hazard mitigation policies (i.e., building codes, setbacks) to implement adaptation strategy recommendations; (7) multi-media education and outreach materials.

The general work plan for 2011-2015 is organized around five principal coastal hazard programming:

- Conduct Coastal Zone Vulnerability Assessment
- Develop and advocate for hazard mitigation and climate adaptation strategies
- Recommend revision of regulations, development of guidelines for OGPe permit reviews, as well as building standards and design considerations for modifications of natural and man-made features in coastal high hazard areas
- Networking and interagency collaboration and implementation
- Education and outreach

Within each programming area a series of specific work activities will be conducted. The scheduling of the work will, in part, be dependent on inputs from other agencies and partners. As a result, the work plan may be subject to significant modification in response to evolving circumstance over which DNER has no control.

YEAR 1: 2011

Description of activities:

Form partnership with multiple agencies, organizations, and experts; collect needed data and knowledge for the GIS-based coastal hazards database and library and the vulnerability assessment; conduct stakeholder listening sessions and risk assessment workshops with invited experts and multiple agencies.

<u>Coastal Zone Vulnerability Assessment</u>

The objectives and outcomes for this segment of Section 309 Coastal Hazards strategy are:

- Work together with multiple agencies and stakeholders to integrate existing coastal hazard and climate variability/change information to assess Puerto Rico's current vulnerability (process started in 2010)

- Systematically collect the relevant climate information into a shared Puerto Rico Climate Research Library for use by the partners
- Develop present day and possible future scenarios for Puerto Rico's coasts and the most vulnerable regions through quantitative and qualitative methods, specifically the development of risk matrices that utilize both quantitative and qualitative data. Methodology for this will largely be taken from the New York City Panel on Climate Change and the Connecticut Adaptation Subcommittee.
- Using U.S. Census data and information (Census tracks-Tiger files) in addition to other geophysical, social, and ecological indicators identify coastal communities currently or potentially vulnerable to coastal hazards and climate change.
- Using PRCZMP aerial photography, satellite imagery, and GIS (and previous studies) identify key geomorphic features and wetlands that provide protection to coastal communities from natural hazards, such as specific eolianite features, offshore cayes, beach and dune systems, mangrove systems, etc.
- Field validate the information through community visits, GPS data collection and interviews to key members of local communities.
- Develop and maintain the GIS Coastal Hazards database and library which will consist of hazard layers obtained from the Commonwealth Office of Emergency Management for all 44 coastal municipalities, features that provide a certain level of buffering capacity, areas that may be affected by "coastal squeeze" in the future due to sea level rise and development "sandwiching" these features, erosion rates from CMO commissioned studies in the last cycle and partner studies, potential marsh advancement zones for future, as well as vulnerability indices from partners and in-house. This type of information will allow CMO to identify those communities and natural areas to be prioritized in the future for management decisions and funding opportunities. Additionally, this type of information and the results from analyses used with the database, will support the justification for hazard mitigation and climate change legislation.
- Using CMO GIS facility, overlay the new FEMA flood maps and results from DNER/PRCMP-CMO and UPR-CaRA efforts (described previously in the Coastal Hazards Assessment) onto existing land use maps and aerial photos to identify and prepare quantitative assessments of potential damage in high vulnerability areas.
- Four workshops and meetings per working group (totaling 16)..
- Annual partnership meeting (1).
- Publish policy briefs with the gathered information and other outreach/education materials.

Outcome(s):

- Partnership with formalized name (tentatively Puerto Rico Climate Change Community or PRCCC) and process;
- GIS-based coastal hazards database and library; Puerto Rico Climate Research Library (for use by the partners);
- Identification of most vulnerable communities, ecosystems, and infrastructure assets; draft sections of vulnerability assessment by the partnership; short policy briefs.

<u>BUDGET Year 1 (2011): $ 129,186</u>

Personnel: NO

Contracts (2): $55,000 and 15,686 for assistance with inputs into the database and library and in identifying vulnerable communities

Workshops: $16,000 (risk assessment workshops including professional facilitation services and consultation)

Conferences and seminar venues: $ 15,000

Facilitator/translation services: $7,500 (facilitator and recording services)

Publications: $ 20,000

YEAR 2: 2012

Description of activities and outcomes:

Collect information on any existing strategies through interviews, email surveys, and literature review; identification and prioritization of hazard mitigation and climate adaptation strategies with partnership and stakeholder engagement; draft an adaptation plan with key recommendations for policies and regulations regarding hazard mitigation and climate adaptation strategies

Hazard mitigation and climate adaptation strategies

The objectives and outcomes are to:

- Identify and assess existing adaptation strategies, being employed for the islands of Puerto Rico through interviews, email surveys, and literature review, including actions that fulfill the definition but are not labeled “adaptation”.
- Through stakeholder engagement and pulling from experiences in U.S. coastal states, Latin America, and other Caribbean islands identify, assess, develop, and prioritize adaptation actions. This process will be conducted at CMO, partnership meetings, and at Adaptation Prioritization Workshops. Create feasibility matrices for the adaptation actions identified to develop policy recommendations for local, commonwealth, federal, civil society, and private sector actors. Example of adaptation recommendations would be standards and design considerations for modifications of natural and man-made features in coastal high hazard areas.
- Conduct a legal study of the laws and regulations that could be amended to incorporate these recommendations.
- Finalize and publish full report of vulnerability assessment work with a user-friendly executive summary in both Spanish and English. Work with partners to disseminate report effectively.
- Publish an adaptation plan document with user-friendly executive summary in both Spanish and English with implementation and maintenance recommendations to be distributed amongst elected and appointed officials for endorsement.
- Ongoing education and outreach efforts and publication of multi-media materials.

Outcome(s):

(1) Vulnerability assessment publication in both Spanish and English;
(2) Legal study
(2) Adaptation plan document with implementation and maintenance recommendations in both Spanish and English;
(3) Multi-media education and outreach materials (1 briefing sheets, one for each of the working groups, 1 six minute video explaining results of the project)

BUDGET Year 2 (2012):: $115,000

Personnel: NO

Contracts (2): $ 65,000 for an editor of the publications and for the legal study

Workshops: $16,000 (Adaptation Prioritization Workshops for 2 working groups and invited stakeholders; professional facilitation services and consultation)

Conferences and seminar venues: $ 15,000

Facilitator/translation services: $7,500 (facilitator and report preparation services)

Publications:$30,000 (Spanish and English versions: Vulnerability Assessment and Adaptation Strategies)

YEAR 3: 2013

Description of activities and outcomes:

Recommend standards and design considerations for regulations and code modifications, particularly of features in high hazard areas;

Develop draft legislation with legal consultation for policies and recommendations such as building codes and other adaptation strategies identified in the adaptation plan. Types of amendments envisioned for building codes are those that foster more adaptive buildings and occupants, such as guidelines for beachfront properties to build on stilts, incorporating possible future shoreline conditions into buildings when in flood-prone areas, etc

Focus of technical studies will be the review and assessment of design standards for natural and man-made features in areas subject to coastal flooding (see examples below). This would lead to new CZMP guidelines.

- Natural features: Focus on preserving and restoring the protective functions of natural shoreline features, such as beaches, dunes, and wetlands (coral reefs, sea grasses, and mangrove systems). Standards and guideline pertain to such actions as dune construction (cross-section and elevation), beach nourishment, constructed wetlands, dredging and dredge spoil disposal, and shorefront stabilization.
- Man-made features: Initial focus will be on DNER facilities and OCRM-funded projects. This would include elevations for roads and trails within natural reserves; guidelines for piers, boat launching facilities, shelters, and related infrastructure, as well as design

criteria for the construction of DNER-funded and Sec.306A-funded facilities to be constructed in the coastal zone.
- Recommend standards and design considerations for modifications of features in high hazard areas;
- Make recommendations to the legislature on such new legislation or on the revision of existing laws and regulations.

Outcomes:

- Guidelines to protect natural features providing protective functions to coastal communities.
- Guidelines for design and construction of public access and nature interpretation on coastal natural reserves and Commonwealth forests.
- Recommendations for standard and design considerations for man-made features in high hazard areas
- Program changes

BUDGET Year 3: 110,000

Personnel: 45,000

Contract: 35,000 for assistance with recommended design standards and considerations by engineer(s) and/or lawyer(s).

Workshops: $4,000

Conferences and seminar venues: $ 15,000 for annual partnership meetings and workshops on design standards

Facilitator/translation services: NO

Publications: $ 11,000

YEAR 4: 2014

Description of activities:

Advocate for the adoption of this legislation by presenting legislative testimony and increasing the effectiveness of outreach and communications.

Recommend standards and design considerations for modifications of natural and man-made features in coastal high hazard areas

- Review the protocols for and participation by DNER/CMO in hazard mitigation planning following presidential declared disasters. The role of DNER in disaster mitigation planning needs to be reviewed to determine the studies and technical support that DNER and the CMO can provide as inputs to post-disaster planning and mitigation. Given DNER's island-wide role in operating pumping stations to alleviate flooding, its experience with coastal erosion, and its lead role in coastal

zone management, a strong case should be made for the inclusion of DNER on the Federal-Commonwealth Post Disaster Hazard Mitigation Teams.

- Collaboration with the Planning Board in the establishment of setback lines and the modification of PB Regulations 13 and 17 for compliance with new FEMA guidelines. The Planning Board has the basic responsibility for directing future public and private development and redevelopment away from hazardous areas, including the high hazard areas delineated as FEMA V-zones and areas vulnerable to inundation from sea level rise. However, the technical expertise for exercising this guidance lies with DNER and the CMO. Therefore, a mechanism has been set up to facilitate this collaboration.
- Develop draft legislation with legal consultation for policies and recommendations such as building codes and other adaptation strategies identified in the adaptation plan;
- Advocate for the adoption of this legislation by presenting legislative testimony and increasing the effectiveness of outreach and communications.
- Implementation of Climate variability and change adaptation strategies. The draft adaptation plan document will be completed in 2012 and, depending on reception by different sectors and agencies, PRCZMP resources and staff will need to be devoted to advocating for and finalizing the draft with government and begin implementation of recommendations, some that have been adopted and others that need to be adopted at this point. Concurrence on risk and vulnerability analyses. The technical work on risk and vulnerability, and assessments of potential for personal injury and property damage should be prepared by DNER/CMO as a Sec. 309 work activity. However, to establish the creditability of the findings, the work should be reviewed and agreed to by a technical inter-agency and stakeholder committee. Participation should include representation from the Planning Board, COE, UPR, NOAA/NWS, and Dept. Public Works.
- Submit findings to the Planning Board and/or other appropriate agency or technical committee electronically and through a series of meetings.

Outcomes:

- Draft legislation containing climate change adaptation strategies.
- Recommendations on setback lines and the modification of PRPB Regulations 13 and 17 for compliance with new FEMA guidelines

BUDGET Year 4: $105,000

Personnel: 45,000

Contract: 25,000 for drafting of legislation

Workshops: $14,000 for annual partnership meeting and other meetings/workshops related to this strategy

Conferences and seminar venues: $ 15,000

Facilitator/translation services: $6,000

Publications: NO

YEAR 5: 2015

Education and outreach

The long-term resolution of coastal hazard issues will require an examination of infrastructure, economic impacts, and financial considerations, as well as the identification of private sector parties-at-interest, such as banks and insurance companies. It will be essential to enlist private sector support and cooperation in all implementation and public education programs.

The objectives of the work on education and outreach are to:

- Provide technical assistance to local governments. Outreach related to coastal hazards is a key and continuing activity, especially in providing advice and technical support to coastal municipalities in integrating hazard mitigation into their plans (i.e. hazard mitigation plans, land use plans, evacuation routes, emergency management plans, etc).

- Prepare brochures, maps and other educational information dealing with (1) risk and vulnerability findings; (2) new FEMA maps and building guidelines; (3) sources for assistance in retrofitting; etc

- Convene regional meetings to exchange information with NGOs, Academia, research institutions, the media, and local officials on coastal flooding problems and implications for planning and regulatory measures. Emphasis should be on opening up avenues of communication between local representatives and citizen groups, and central government agencies. Such meetings, convened by DNER, could be co-hosted with Planning Board, FEMA.

- Media workshops and meetings. Raise awareness of coastal hazards, climate variability and change, among the media. A main objective of the outreach strategy will be to effectively communicate hazard science, local impacts, and strategies with media outlets throughout the island and the mainland so as to support accurate reporting and communication to local officials and the public.

Outcomes:

- Outreach and educational material related to coastal hazards
- Strengthened partnerships to promote climate change adaptation and coastal hazards resiliency.
- Workshops for media representatives, reporters and journalists to learn more about climate change and coastal hazards.
- Media dissemination of climate change and coastal hazards preparedness and adaptation.

BUDGET Year 5: $105,000

Personnel: 45,000

Contract: $15,000 (Media and outreach campaign design)

Workshops: $14,000

Conferences and seminar venues: $ 15,000

Facilitator/translation services: $6,000

Publications: 15,000

VII. Fiscal and Technical Needs

A. Fiscal Needs: If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the applying agency has made, if any, to secure additional state funds from the legislature and/or other sources to support this strategy.

The requested funding combined with the funding from the NOAA Coastal Services Center's Coastal Management Fellowship should be sufficient to carry out the proposed strategy during years 1 and 2. Efforts will be made to secure funds from the legislature to support this strategy.

B. Technical Needs: If the state does not possess the technical knowledge, skills, or equipment to carry out the proposed strategy, identify these needs. Provide a brief description of what efforts the applying agency has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).

Wetlands Coastal Hazards Five Year Budget Summary

SUMMARY BUDGET ALLOCATION FOR PRIORITY PROGRAM AREAS BY FISCAL YEAR

SECCION 309 FUNDS BY FISCAL YEAR

Year	Enhancement Area	Priority	Amount
2011	Wetlands	High	$85,814
2011	Coastal Hazards	High	$129,186
TOTAL YEAR 1			**$215,000**

2012	Wetlands	High	$78,500
2012	Coastal Hazards	High	$115,000
TOTAL YEAR 2			**$193,500**
2013	Wetlands	High	$83,500
2013	Coastal Hazards	High	$110,000
TOTAL YEAR 3			**$193,500**
2014	Wetlands	High	$88,500
2014	Coastal Hazards	High	$105,000
TOTAL YEAR 4			**$193,500**
2015	Wetlands	High	$88,500
2015	Coastal Hazards	High	$105,000
TOTAL YEAR 5			**$193,500**

ATTACHMENTS

1. PRCMP Performance Measures System : Contextual Measures